UNITED STATES OF AMERICA:
WAR DEPARTMENT.

# MONTHLY WEATHER REVIEW.

## (GENERAL WEATHER SERVICE OF THE UNITED STATES.)

## OCTOBER, 1886.

PREPARED UNDER THE DIRECTION OF
**BRIG. & BVT. MAJ. GEN'L W. B. HAZEN,**
CHIEF SIGNAL OFFICER OF THE ARMY,

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1886.

*List of merchant marine steam and sailing vessels from which International Simultaneous Meteorological reports were received at the Office of the Chief Signal Officer, U. S. Army, Washington, D. C., in time to be used in the preparation of the Weather Review for the month of October, 1886.*

| | Name of vessel. | Captain. |
|---|---|---|
| | *Allan Line.* | |
| Br. | s. s. Buenos Ayrean | Capt. J. Scott. |
| | Circassian | Wm. Richardson. |
| | Grecian | C. E. LeGallais. |
| | Hibernian | John Brown. |
| | Nova Scotian | R. H. Hughes. |
| | Scandinavian | John Park. |
| | *American Line.* | |
| Br. | s. s. British King | John Kelly. |
| | British Prince | Samuel Nowell. |
| | Lord Clive | P. Urquhart. |
| | *Anchor Line.* | |
| Br. | s. s. Alexandria | Robt. Pert. |
| | Anchoria | J. J. Small |
| | British Crown | Archibald Smith. |
| | British Queen | R. Wills. |
| | Circassia | A. Campbell. |
| | City of Rome | R. D. Munro. |
| | Devonia | Hugh Young. |
| | Dorian | J. McKeague. |
| | Trinacria | Geo. Mitchell. |
| | *Arrow Line.* | |
| Br. | s. s. Critic | W. B. Lord. |
| | *Atlas Line.* | |
| Br. | s. s. Atlas | J. W. Samson. |
| | Alvo | D. Williams. |
| | Andes | T. M. MacKnight. |
| | Claribel | T. M. MacKnight. |
| | *Booth's S. S. Co. (limited).* | |
| Br. | s. s. Clement | Thomas Burley. |
| | Jerome | Benj. Crimp. |
| | *Bordeaux Steam Navigation Company.* | |
| Fr. | s. s. Château Yquem | C. Journell. |
| | *Bristol-City Line.* | |
| Br. | s. s. Brooklyn City | W. Fitt. |
| | Wells City | T. L. Weiss. |
| | *Cromwell Line.* | |
| Am. | s. s. Louisiana | E. V. Gager. |
| | *Cunard Line.* | |
| Br. | s. s. Antonia | W. H. F. Hains. |
| | Catalonia | Alex. McKay. |
| | Cephalonia | Henry Walker. |
| | Etruria | T. Cook. |
| | Pavonia | B. Woolfenden. |
| | Samaria | T. Roberts. |
| | Scythia | T. Roberts. |
| | Servia | H. McKay. |
| | Umbria | W. McMickan. |
| | *Edward Cave's S. S. Line.* | |
| Ger. | s. s. Amalfi | Julius Bahr. |
| | Australia | G. Frank. |
| | Polynesia | A. Kuhn. |
| | *Fabre Line.* | |
| Fr. | s. s. Neustria | P. Verrières. |
| | *Furness Line.* | |
| Br. | s. s. Borderer | F. Manley. |
| | Boston City | W. T. Sherborne. |
| | Durham City | M. P. Lund. |
| | *General Trans-Atlantic Steamship Co.* | |
| Fr. | s. s. La Bourgogne | Franguel. |
| | La Bretagne | M. de Jousselin. |
| | La Champagne | E. Traub. |
| | La Gascogne | Santelli. |
| | La Normandie | G. de Kersabiec. |
| | *Great Western S. S. Line.* | |
| Br. | s. s. Dorset | Ch. Off. E. Crossman. |
| | *Guion Line.* | |
| Br. | s. s. Alaska | Capt. G. S. Murray. |
| | Arizona | S. Brooks. |
| | Nevada | John Douglas. |
| | Wisconsin | Edward Bentley. |
| | Wyoming | C. L. Rigby. |
| | *Hamburg-American Line.* | |
| Ger. | s. s. Bohemia | R. Kurlown. |
| | Gellert | W. Kühleweiu |
| | Hammonia | H. F. Schwensen. |
| | Lessing | H. Barends. |
| | Rhætia | H. Vogelgesang. |
| | Rugia | A. Albers. |
| | Westend | C. Hebich. |
| | Westphalia | Droescher. |
| | *Inman Line.* | |
| Br. | s. s. City of Berlin | Francis S. Land. |
| | *Lampert & Holt's Steamship Company.* | |
| Br. | s. s. Bessel | Chas. J. Watson. |
| | Dalton | J. Russell. |
| | Holbein | T. T. Farrell. |
| | Othere | Jas. Clark. |
| | *Leyland Line.* | |
| Br. | s. s. Bavarian | R. Leask. |
| | Bulgarian | E. Parry. |
| | Istrian | T. H. Fox. |
| | Virginian | M. Fitt. |
| | *Mallory Line.* | |
| Am. | s. s. Alamo | S. Risk. |
| | Colorado | Jas. Daniels. |
| | Lampasas | M. B. Crowell. |
| | Rio Grande | J. F. Lewis. |
| | San Marcos | A. C. Burrows. |
| | *Mediterranean & New York S. S. Co.* | |
| Br. | s. s. Ponca | Wm. Bowen. |
| | Pontiac | R. Blyth |
| | *Mon. & Dominion S. S. Co.* | |
| Br. | s. s. Montreal | F. Boudette. |
| | Sarnia | Joseph Gibson. |
| | Toronto | Jas. McAuley. |
| | *Monarch Line.* | |
| Br. | s. s. Assyrian Monarch | Capt. John Harrison. |
| | Lydian Monarch | T. C. Huggett. |
| | *Morgan Line.* | |
| Am. | s. s. Eureka | R. B. Quick. |
| | *National Line.* | |
| Br. | s. s. America | R. W. Grace. |
| | Canada | Thos. Foote. |
| | Denmark | R. S. Rigby. |
| | Egypt | J. Sumner. |
| | England | T. P. Heeley. |
| | Erin | J. Robinson. |
| | France | A. D. Hadley. |
| | Greece | A. J. Jeffrey. |
| | Holland | W. Tyson. |
| | Italy | W. Pearce. |
| | The Queen | J. Milligan. |
| | *Navigazione Generale Italiana.* | |
| It. | s. s. Indipendente | P. Pirandello. |
| | *New York and Cuba Mail S. S. Co.* | |
| Am. | s. s. Cienfuegos | F. M. Faircloth. |
| | *N. Y., Havana & Mexican Mail S. S. Co.* | |
| Am. | s. s. City of Alexandria | J. W. Reynolds. |
| | City of Washington | W. M. Rittig. |
| | *North German Lloyd Steamship Co.* | |
| Ger. | s. s. Aller | F. Hamelmann. |
| | Ameriea | H. Bodeker. |
| | Donau | H. Swpmer. |
| | Elder | H. Helmers. |
| | Elbe | H. Christoffers. |
| | Ems | T. Jungst. |
| | Fulda | B. Ringk. |
| | Hermann | A. Kohlmann. |
| | Main | R. Sander. |
| | Rhein | L. Jahns. |
| | Saale | H. Reichter. |
| | Trave | W. Willigerod. |
| | Werra | R. Bussins. |
| | *Occidental & Oriental S. S. Co.* | |
| Br. | s. s. Oceanic | Jas. Thomson. |
| | *Ocean Steamship Company.* | |
| Am. | s. s. Chattahoochee | J. W. Catharine. |
| | City of Augusta | K. S. Nickerson. |
| | City of Savannah | Ch. Off. Edwards. |
| | *Old Dominion Steamship Company.* | |
| Am. | s. s. Manhattan | Capt. Frank Stevens. |
| | *Oregon Railway and Navigation Co.* | |
| Am. | s. s. Columbia | Fred Bolles. |
| | Oregon | E. Polemann. |
| | *Pacific Coast Steamship Company.* | |
| Am. | s. s. State of California | G. Debney. |
| | *Pacific Mail Steamship Company.* | |
| Am. | s. s. City of Para | L. Dexter. |
| | City of Pekin | W. C. Dearborn. |
| | Colon | Chas. C. Lima. |
| | Granada | W. B. Seabury. |
| | San Blas | T. Chapman. |
| | *Quebec Steamship Company.* | |
| Br. | s. s. Muriel | G. S. Locke. |
| | Orinoco | J. S. Garvin. |
| | Trinidad | W. J. Fraser. |
| | *Red "D" Line.* | |
| Am. | s. s. Philadelphia | Sam. Hess. |
| | *Red Cross Line.* | |
| Br. | s. s. Capulet | W. H. Ellis. |
| | *Red Star Line.* | |
| Belg. | s. s. Belgenland | W. A. Beynon. |
| | Nederland | A. J. Griffin. |
| | Noordland | H. E. Nickels. |
| | Pennland | Rud. Weyer. |
| | Rhynland | J. C. Jamison. |
| | Switzerland | H. Buschmann. |
| | Waesland | J. Uberweg. |
| | *Rotterdam Line.* | |
| Dtch. | s. s. Edam | J. H. Taat. |
| | P. Caland | T. H. Bonjer. |
| | Schiedam | A. Potjer. |
| | *State Line.* | |
| Br. | s. s. State of Georgia | G. Moodie. |
| | State of Pennsylvania | A. J. A. Mann. |
| | State of Nebraska | A. G. Brass. |
| | *Thingvalla Line.* | |
| Dan. | s. s. Geiser | C. W. Möller. |
| | Hekla | A. G. Thomsen. |
| | Island | W. Skjödt. |
| | Thingvalla | S. T. H. Laub. |
| | *Twin Screw Line.* | |
| Br. | s. s. Richmond Hill | A. Hyde. |
| | *Tyne & Wear Steamship Company.* | |
| Br. | s. s. City of Newcastle | W. T. Irving. |
| | *Warren Line.* | |
| Br. | s. s. Iowa | Samuel Walters. |
| | Norseman | E. Maddox. |
| | *Wells Ward Line.* | |
| Br. | s. s. Camden | S. R. Chandler. |
| | Richmond | J. Garson. |
| | *White Cross Line.* | |
| Belg. | s. s. Jan Breydel | H. Meyer. |
| | Pieter de Coninck | E. Smit. |
| | *White Star Line.* | |
| Br. | s. s. Adriatic | H. Parsell. |
| | Britannic | H. Perry. |
| | Celtic | D. Gleadell. |
| | Germanic | C. W. Kennedy. |
| | *Wilson Line.* | |
| Br. | s. s. Bassano | Capt. W. Rea. |
| | Buffalo | J. H Malet. |
| | Galileo | R. Potter. |
| | Marengo | W Abbott. |
| | Salerno | E. H. Rogers. |
| | Sorrento | J. T. Rogers. |
| | *Miscellaneous.* | |
| Br. | s. s. Angerton | S. M. Orr. |
| | Athens | Ch. Off. Emi Towns. |
| | Cranbrook | Capt. John W. Harvey |
| | Edith Gobbin | John H. Bennett. |
| | Elstow | T. Robertson. |
| | Fitzroy | Henry Gibb. |
| Span. | Hugo | A. de Mugica. |
| Am. | Lorenzo D. Baker | Warren F. Wiley. |
| Nor. | Ludvig Holberg | N. Hongo. |
| Br. | Madrid | M. Garson. |
| | Matthew Bedlington | Thomas Kirby. |
| Span. | Navarro | S. de Aldecocea. |
| Br. | Ocean Prince | W. J. Milburn. |
| | Rover | Jas. Mansfield. |
| | Salisbury | W. Durham. |
| | Saint Ronans | Henry Campbell. |
| | Sacrobosco | R. S. Thompson. |
| Span. | Serra | F. de Luzarraga. |
| Br. | Viola | L. Murray. |
| | *New York Herald Weather Service.* | |
| Am. | s. s. Acapulco | Coye |
| Br. | Alene | Siders. |
| | Alvena | F. McKay. |
| | Alvo | D. Williams. |
| | Advance | J. T. Lord. |
| | Angerton | S. M. Orr. |
| | Athos | Low. |
| | Bothnia | Dutton. |
| Am. | Caracas | W. M. Hopkins. |
| | Chalmette | J. B. Perry. |
| Br. | City of Chester | Lewis. |
| Am. | City of Puebla | Deaken. |
| | City of Richmond | A. Redford. |
| Br. | Comal | J. Bolger. |
| | Craighill | W. H. Bennett. |
| | Egyptian Monarch | W. S. Morgan. |
| Am. | El Monte | J. W. Hawthorne. |
| | El Paso | H. S. Quick. |
| Br. | Ethiopia | J. Wilson. |
| Am. | Hudson | H. R. Freeman. |
| | Lone Star | R. M. Howe. |
| Br. | Miranda | E. Bendon. |
| Am. | Newport | W. G. Shackford. |
| | Niagara | G. V. Bemis. |
| Br. | Otranto | W. Rippoth. |
| | Portia | H. Dawson. |
| Am. | Rio Grande | J. F. Lewis. |
| | Valencia | W. Woodrick. |
| Dtch. | W. A. Scholten | G. J. Vis. |
| | Warwick | J. W. Janes. |
| Br. | Westerniand | Com. W. G. Randle. |
| | *Sailing vessels.* | |
| Br. | bk. Abyssinian | Capt. John Hughes. |
| Am. | bg. Abbie Clifford | D. W. Storer. |
| Br. | Achsah | A. M. Shaw. |
| It. | bk Agostino Bombo | Vincenzo Basso. |
| Am. | bgt. Boston Marine | H. V. Porter. |
| Br. | sp. British Isles | G. Southcott. |
| | Charles S. Whitney | Geo. D. Spicer. |
| Am. | schr. Comet | W. H. Aldrich. |
| | bk. Don Justo | E. Orcutt. |
| | schr. Edward R. Emerson | A. H. Child. |
| Br. | bkt. Elcho | P. Aug. Oxelgren. |
| | bk. Eliza Barss | Henry H. Hollis. |
| Am. | schr. Ella A. Warner | H. J. Greaves. |
| | Ettie H. Lister | Smith D. Mason. |
| Br. | sp. F. B. Taylor | J. A. Tulley. |
| Am. | schr. Florence Rogers | J. S. F. McLeod. |
| | bk. Fluorine | Wm. Manson. |
| Ger. | sp. Friedlander | Joh. Bellmer. |
| Am. | bk. Harriet S. Jackson | W. T. Bacon. |
| Ger. | sp. Hedwig | Th. Minssen. |
| | Hugo | Joh. Kuhlken. |
| | Ida | Joh. Winters. |
| Br. | bk. Iodine | Adam Smith. |
| Am. | schr. Jennie A. Stubbs | Chas. M. Haskell. |
| | bkt. Josephine | Charles Brown. |
| Nor. | sp. Komandor Svend Foyn | Johan Bryde. |
| Ger. | bk. Leocadia | John Stohff. |
| Am. | bkt. Levanter | Geo. F. Gerry. |
| | bg. L. & W. Armstrong | A. Alexander. |
| | sp Magellan | E. S. Manson. |
| Br. | bk. Mary | Chas. Acocks. |
| Am. | bg. Mary Fink | D. F. Darrah. |
| Nor. | sp. Mathilda | T. J. Hansen. |
| Br. | Bk. Minnie G. Whitney | J. D. Foley. |
| Am. | bg. Moraney | Ch. Off. R. H. Cox. |
| | bkt. Nellie M. Slade | Capt. J. A. Gould. |
| Ger | bk. Pillau | G. Gorlach. |
| Br. | sp. Sapphire | Geo. W. Murray. |
| Am. | bk. Sarah | L. R. Hale. |
| Ger. | sp. Shakspere | Carl Muller. |
| Am. | bg. Tenerife | W. S. Richardson. |
| Ger. | bk. Victoria | B. F. Behm. |
| Am. | bg Water Witch | Max Knaebel. |
| | sch. W. H. Fredson | A. J. Biddle. |
| Br. | sp. Winnifred | R. MacDonald. |
| Am. | Light-ship No. 37 | Andrew Jackson. |

# MONTHLY WEATHER REVIEW.

VOL. XIV. WASHINGTON CITY, OCTOBER, 1886. No. 10.

## INTRODUCTION.

This REVIEW contains a general summary of the meteorological conditions which prevailed over the United States and Canada during October, 1886, based upon the reports from the regular and voluntary observers of the Signal Service and from co-operating state weather services.

Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i. In tracing the centres of the paths of these storms, data from the reports of one hundred and ninety-three vessels have been used.

On this chart is also shown the distribution of icebergs reported during the month.

On chart i for this month are traced the paths of nine areas of low pressure; the average number for October during the last thirteen years being 10.5.

The most severe storm of the month, described as number vi, was quite destructive during its passage over the upper Mississippi valley and the Lake region on the 14th; it was accompanied by high winds and unusually low barometer, the lowest recorded being 28.93, at Mackinaw City, Michigan, at 3 p. m. of the 14th.

Owing to the heavy storm that prevailed in the Gulf of Mexico from the 9th to the 12th very high tides occurred along the Gulf coast on the 12th, causing considerable loss of life and property in Louisiana and eastern Texas.

A noteworthy feature in connection with the meteorology of the month is the fact that the mean barometric readings are decidedly above the normal in all parts of the country lying east of the Rocky Mountains, while the rainfall of the same districts is largely deficient as compared with the normal.

The mean temperature is above the normal in the upper lake region, upper Mississippi valley, Missouri Valley, the extreme northwest, and in eastern Montana; in the Southern States and along the Pacific coast it is below the normal; the departures in the other districts are small.

Under "Notes and extracts" in this REVIEW will be found a paper by Junior Prof. T. Russell containing the results and a short discussion of the comparative readings of still and whirled wet and dry-bulb thermometers as made at thirty-seven Signal Service stations during August and September, 1886.

Mr. M. A. Veeder, of Lyons, New York, furnishes an interesting note on sun spots and attending phenomena.

In addition to the regular reports from the cotton districts a table is given showing the average rainfall and mean of the maximum and minimum temperatures during the growing season from 1882 to 1886, inclusive, also the total acreage and yield of cotton for the first four years mentioned.

In the preparation of this REVIEW the following data, received up to November 20, 1886, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and twenty-one Canadian stations, as telegraphed to this office; one hundred and sixty-four monthly journals; one hundred and fifty-six monthly means from the former, and twenty-one monthly means from the latter; two hundred and seventy-eight monthly registers from voluntary observers; fifty-five monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Alabama, Indiana, Illinois, Iowa, Minnesota, Mississippi, Missouri, Nebraska, New England, Ohio, and Tennessee; trustworthy newspaper extracts, and special reports.

## ATMOSPHERIC PRESSURE.

[*Expressed in inches and hundredths.*]

The distribution of mean pressure for October, 1886, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

The mean atmospheric pressure of the United States during the month is greatest over the country lying east of the Mississippi River; over this area the pressure averages about 30.17. An examination of chart ii will show that the area of maximum pressure, enclosed by the isobar of 30.20, extends over Tennessee, Kentucky, and the southern part of Indiana and Ohio; within this area the highest pressure, 30.22, occurred at Knoxville, Tennessee. From this isobar the pressure decreases in all directions until the isobar of 30.15 is reached. This line extends along the Atlantic coast from Eastport, Maine, to Savannah, Georgia, and includes the greater portion of the country lying east of the Mississippi River. The area of minimum pressure, within which the mean for the month is 29.95 or less, covers southeastern California, southern Nevada, southwestern Utah, and western Arizona. The lowest barometric mean for the month, 29.91, is reported from Frisco, Utah. Two areas of comparatively low pressure, indicated by the isobar of 30.00, are also found on chart ii; one extends over northern Dakota and Montana, the other covers southern Florida.

The departures from the normal pressure are given in the table of miscellaneous meteorological data, and are also shown on chart iv by lines connecting stations of equal departure. The mean pressure for the month, when compared with the normal as deduced from the observations of the past fourteen years, will be found to be in excess in all parts of the country except over a comparatively small area covering the northern and middle plateau regions, where the pressure is normal or slightly below. The largest departures occur in the Ohio and Mississippi valleys, the Lake region, and in Tennessee, where they range from .06 to .13 in excess of the normal. In the states bordering on the Atlantic Ocean and Gulf of Mexico the pressure averages about .06 in excess of the normal, and ranges from .04 at Boston, Massachusetts, to .10 at Galveston and Brownsville, Texas. On the Pacific slope the departures in excess of the normal vary from .02 at Fort Canby, Washington Territory, to .08 at Los Angeles and San Diego, California.

When compared with the mean pressure of the preceding month, September, 1886, an increase is noted in all parts of the United States. The increase is greatest in the Missouri, Mississippi, and Ohio valleys and the Lake region; in these districts it ranges from .10 at Erie, Pennsylvania, to .16 at Leavenworth, Kansas. The increase in California and Arizona is also large, being .15 and .13 at San Francisco and Sacramento, California, respectively, and .19 at Yuma, Arizona. In New England and the Atlantic States the increase is about .04; in the Gulf States it averages .11, one station, Brownsville, Texas, shows an increase of .17.

### BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are given in the table of miscellaneous data. The greatest ranges occur in the Lake region and over the northern part of the Mississippi and Missouri valleys; owing to the unusually low pressure that accompanied the storm of the 14th in its passage over the upper Mississippi valley and the Lake region the monthly barometric ranges in those districts are exceptionally large.

The following are some of the extreme monthly ranges:

| Greatest. | | Least. | |
|---|---|---|---|
| | *Inch.* | | *Inch.* |
| Mackinaw City, Michigan | 1.71 | Jacksonville, Florida | 0.31 |
| Alpena, Michigan | 1.65 | Sanford, Florida | 0.31 |
| Escanaba, Michigan | 1.54 | San Diego, California | 0.34 |
| Marquette, Michigan | 1.48 | Los Angeles, California | 0.35 |
| Grand Haven, Michigan | 1.48 | Key West, Florida | 0.39 |
| Green Bay, Wisconsin | 1.47 | Cedar Keys, Florida | 0.39 |
| Dubuque, Iowa | 1.45 | Yuma, Arizona | 0.40 |
| Milwaukee, Wisconsin | 1.42 | Savannah, Georgia | 0.41 |
| La Crosse, Wisconsin | 1.39 | Montgomery, Alabama | 0.43 |

### AREAS OF HIGH PRESSURE.

[Prepared by Lieut. JOHN C. WALSHE, Signal Corps, U. S. Army, Assistant.]

Ten areas of high pressure appeared within the limits of the United States during the month of October, 1886. The majority of these entered the Pacific coast from the ocean, with a general easterly movement, and three of the others advanced southward over the valley of the Assinaboine, and thence generally in a southeasterly direction. The most noticeable feature of the month was the almost uniformly regular movement eastward. The maximum pressure over the United States occurred on the 25th and 26th, when the area described as number ix covered the whole country, accompanied by low temperature and heavy frosts, extending to the Southern States.

I.—The month opened with a large and well-defined area of high pressure over the upper Mississippi and the Missouri valleys, which moved slowly eastward and was central over Illinois and Indiana at midnight of the 1st. The pressure gradually increased and was considerably above the normal over the entire Mississippi Valley and the Lake region on the 2d. The temperature rose slowly in the Northwest in rear of this area as it moved eastward on the 2d and 3d. The midnight map of the 3d showed the centre of high pressure over the middle Atlantic states, after which date it slowly disappeared into the Atlantic. During the passage of this area general light frosts extended southward to Memphis and Nashville, Tennessee.

II.—On the afternoon of the 2d an area of high pressure entering from the Pacific appeared over Oregon and Washington Territory and gradually moved eastward, extending over the Rocky Mountain region on that date. This area remained nearly stationary on the 3d, developing little increase of pressure. The morning map of the 4th showed it central over Nebraska and Dakota, well defined, and in rear of a low area moving toward the Saint Lawrence Valley. It drew slowly eastward on the 5th over the Lake region, and at the midnight observation of that date was central on Lake Ontario. On the 6th it remained nearly stationary, and then moved slowly down the Saint Lawrence Valley and into the Atlantic on the morning of the 7th, leaving an area of moderately high pressure over the Eastern States, attended by clear or fair weather on the 8th, 9th, 10th, and 11th, with light rains on the coast of the south Atlantic states, finally drawing into the Atlantic Ocean on the 12th. No marked features attended the translation of this area of high pressure eastward other than a slight fall in temperature and generally clear or fair weather.

III.—This area entered from the Pacific coast over northern California and Oregon and was first observed on the morning of the 6th. An area of moderately low pressure on that date extended southward from the Saskatchewan Valley over Dakota and Minnesota, and during the 6th spread still further south until it formed an elliptical trough of low pressure bounded by the isobar of 29.8. To the east of this lay an area of high pressure central over the Lake region. These conditions produced light rains in Colorado on the 6th, and the eastern progress of this area over the Rocky Mountains was retarded. It remained nearly stationary over Utah and Nevada on the 7th, with slowly diminishing pressure, until it lost well-defined outlines as an area of high pressure and gradually dissipated.

IV.—This area was first observed advancing southward over Manitoba on the afternoon of the 10th, and had probably entered from the Pacific over Vancouver Island, where an area of moderately high pressure was noticed on the 9th. A well-defined low area was central over Utah, bounded by the isobar of 29.6, during the last-mentioned date, and the advance of this area of high pressure produced rains in Minnesota, Dakota, and Nevada on the 10th. On the 11th the pressure increased over the Saskatchewan Valley, but appeared to remain stationary—producing a slight fall in temperature and precipitation in the northern lake region on the 12th, after which it dissipated by the gradual decrease of pressure.

V.—This area entered from the Pacific over the coast of California and was first observed on the afternoon of the 12th central over Nevada. An area of moderately low pressure extended over Kansas and northwestern Texas, bounded by the isobar of 29.8, and another depression was central in Manitoba, bounded by the isobar of 29.7. These conditions retarded somewhat the advance eastward of this area, and the pressure at the centre fell slowly to 30.1 as the area increased in extent. It moved slowly southward on the 13th, and the morning map of the 14th showed it central over New Mexico, while a storm of marked energy was moving over Iowa, the pressure having fallen there to 29.10. This area on the 14th began to increase in pressure and move slowly eastward and northward until it formed an area of high pressure advancing southward from the Saskatchewan Valley. The movement of this area, although the pressure was but slightly above the normal, was attended by a marked fall in temperature over the Rocky Mountain region.

VI.—This area moved southward from the Saskatchewan Valley and was first observed on the afternoon of the 14th, at which time a depression of remarkable energy existed in the Lake region. The pressure increased up to midnight and the area widened in extent—the morning map of the 15th showing the maximum pressure extending from Dakota to the valley of the Assinaboine and bounded by the isobar of 30.5, attended with a marked fall in temperature. The barometric gradient extended with great regularity to the coast of Oregon—pressure 29.7, and to the Saint Lawrence Valley, the pressure at Quebec being 29.5. The shape assumed by this high area was elliptical, and the major axis extended from the Assinaboine River to Palestine, Texas. The pressure continued to increase over Minnesota, and the barometer rose to 30.67 at the midnight observation at Saint Vincent, Minnesota. The southeasterly winds on the west side of this high area produced rains in the upper Missouri valley, while the northwesterly winds on the east side produced rains and light snows in the Lake region. It moved slowly southeastward on the 16th, and by midnight was central over Pennsylvania, with reduced

pressure, the isobar of 30.4 bounding New York, Pennsylvania, Ohio, Virginia, and West Virginia, with temperature below the normal. During the 17th it moved slowly off the coast into the Atlantic Ocean, attended by light rains in the Lake region, due to the presence of an area of low pressure.

VII.—This area appeared over the Assinaboine Valley on the morning of the 17th, and on that date moved slowly eastward over Lake Superior, with a slight increase of pressure. While it was not well-defined in outline inside the limits of observation it joined the rear of the area described as number vi and extended from the Mississippi River to the Gulf of Saint Lawrence, the barometric pressure ranging from 30.20 over the Mississippi Valley to 30.43 on the coast of Nova Scotia on the morning of the 18th. General light rains and snow prevailed from New Brunswick to Lake Michigan on the night of the 17th. By midnight of the 18th the centre of high pressure had moved to the mouth of the Saint Lawrence, the barometer slowly rising, and during the 19th it continued moving slowly eastward. The morning map of that date showed the isobar of 30.60 on the New England coast and extending northward to Halifax, with clear or fair weather from the Mississippi River to the Atlantic coast, accompanied by a marked fall in temperature. The midnight map of the 20th showed the western quadrant of this high area central over the Carolinas and Virginia, after which date it slowly drew into the Atlantic leaving an area of low pressure north of the Saint Lawrence, with temperature above the normal, and light rains in the Lake region.

VIII.—The afternoon map of the 19th showed the previously described high area (number vii) moving off the coast into the Atlantic, and in the rear of it an elliptical trough of low pressure extending from Arizona to Minnesota. To the west of this an area of moderately high pressure appeared, reaching from Utah to the coast of California and Oregon. This area advanced eastward with increasing pressure and on the morning of the 20th was central over Colorado and Utah, with a pressure of 30.46 at Salt Lake City, Utah, on the afternoon of that date. An elliptical area, bounded by the isobar of 30.30, covered the entire Rocky Mountain region and extended from eastern Kansas to the Pacific coast, having its major axis nearly due east and west. It moved slowly, with slight increase of pressure, and was central near North Platte, Nebraska, at midnight of the 20th. The morning map of the 21st showed the centre of high pressure at Leavenworth, Kansas, and on that date it moved slowly eastward, decreasing in pressure. It was central at Indianapolis, Indiana, with barometer 30.36 and temperature nearly normal, at the midnight observation of that date. The afternoon map of the 22d showed the centre nearly stationary, with pressure much reduced. On the 23d it moved slowly to the northeast over the Saint Lawrence Valley and Lake Ontario, the pressure slightly increasing at the centre, and followed on the 24th by a depression central over Lake Superior. On the last-named date it slowly disappeared eastward off the coast of Nova Scotia.

IX.—The morning map of the 22d showed an area of high pressure (number viii) over the middle Atlantic states and the Ohio Valley, with another high area over California, which had entered from the Pacific on the 21st. Between these two areas of high pressure an elliptical depression extended from northern Dakota to southern Colorado, and in front of this, general frosts occurred on the night of the 21st, and light rains on the 22d. The area of high pressure over California advanced slowly eastward to the central Rocky Mountain districts on the 22d, and then, with moderately high pressure (30.20), remained nearly stationary, owing to the influence of a depression moving southeastward from Manitoba, which was followed by an area of high pressure. This produced an increase of pressure over Montana and Idaho, and the two high areas merged, moving slowly east, attended by a fall in temperature and increasing pressure at the centre. On the afternoon of the 24th it was central over the upper Missouri valley. The pressure continued to increase slowly and the temperature fell rapidly. The morning map of the 25th showed the maximum pressure in Minnesota. On that date the area increased in extent, moving eastward. The isobar of 30.6 bounded Minnesota, Nebraska, Kansas, western Iowa, and Wisconsin, together with the region north of Lake Superior. The temperature fell markedly in this entire region, and heavy frosts occurred, extending south to the Indian Territory. The maximum pressure at the centre of this high area on the 26th was over 30.70 at La Crosse, Wisconsin. The pressure over the entire United States and British possesions, inside the limits of observation, varied from 30.70, at the centre, to 30.10. On the 26th the movement eastward of the centre was not well defined, and the temperature fell below the freezing point along the line of the major axis from Lake Superior to northern Texas, while light rains fell over nearly the entire region east of the Mississippi River to the Atlantic coast. On the afternoon of the 27th the pressure had fallen to 30.30 and the area gradually dissipated without well-defined movement of translation, and attended with light rains in the Lake region.

X.—An area of moderate pressure, bounded by the isobar of 30.10, covered the valley of the lower Mississippi at the midnight observation of the 28th and, with increasing pressure at the centre, moved slowly northward on the 29th. The afternoon map of that date showed the pressure increased at the centre to 30.20 and the midnight observation showed a pressure of 30.30 central over Indiana and Kentucky. The pressure at the centre continued to increase slowly, attended on the 30th with a marked fall in temperature and frosts, extending south and east to northern Georgia and the Carolinas. This area remained nearly stationary on the 30th and 31st, while an area of low pressure, attended with light rains, was moving northward off the coast of the middle Atlantic and New England states.

## AREAS OF LOW PRESSURE.

[Prepared by Lieut. JOHN C. WALSHE, Signal Corps, U. S. Army, Assistant.]

Nine areas of low pressure have been traced from the tri-daily weather charts of the Signal Service for the month of October, 1886. The most remarkable of these disturbances were numbers iv and vi. From the chart it will be readily seen that, as in September, 1886, no area of low pressure passed over the region bounded by the lower lakes, the Mississippi River, the Atlantic Ocean, and the east Gulf shore line. Four of these areas developed in the extreme northwest, two on the Pacific slope, one in the Gulf of Mexico, and one, the severest storm of the month, in Kansas. The tracks of the low areas were generally more to the northward of the Saint Lawrence Valley than the average of previous years, and another noticeable feature of the month is the retrogression of the area of development of storm-centres in the extreme northwest.

The following table shows the latitude and longitude in which each area of low pressure was first and last observed, with the average rate of translation in miles per hour:

| Areas of low pressure. | First observed. | | Last observed. | | Average velocity of translation in miles per hour. |
|---|---|---|---|---|---|
| | Lat. N. | Long. W. | Lat. N. | Long. W. | |
| | ° ′ | ° ′ | ° ′ | ° ′ | |
| No. I | 50 00 | 103 00 | 47 00 | 82 00 | 32.0 |
| II | 46 00 | 112 00 | 49 00 | 97 00 | 28.0 |
| III | 41 00 | 112 00 | 36 00 | 107 00 | 19.0 |
| IV | 21 00 | 84 00 | 33 00 | 93 00 | 12.0 |
| V | 51 00 | 114 00 | 50 00 | 97 00 | 32.0 |
| VI | 39 00 | 97 00 | 48 00 | 63 00 | 30.0 |
| VII | 41 00 | 120 00 | 36 00 | 107 00 | 14.0 |
| VIII | 47 00 | 97 00 | 51 00 | 64 00 | 34.0 |
| IX | 52 00 | 111 00 | 47 00 | 80 00 | 32.0 |

Average rate of movement, 26 miles per hour.

I.—This depression was first observed developing in the valley of the upper Missouri on the morning of the 2d, in rear of an area of moderately high pressure central over the Mississippi Valley and the Middle States. It developed comparatively little energy inside the limits of observation and moved

eastward through the Canadian Provinces until it dissipated by a gradual increase of pressure on the morning of the 4th.

II.—This area developed on the morning of the 8th in Montana, while another of moderately low pressure, attended by light rains, was central in northwestern Texas. It became more clearly defined in the afternoon as an elliptical depression, bounded by the isobar of 29.70, extending in a southwesterly direction over the northern Rocky Mountain region. The pressure decreased in the northern part of this ellipse, attended with a light rainfall in the northwestern territories, but developed little energy and remained nearly stationary on the 9th, extending in a trough of low pressure from Colorado and Utah to northern Minnesota, the northern part of which filled up and gradually dissipated after that date.

III.—During the afternoon of the 9th the depression described in number ii underwent a transformation. The southern part developed a considerable decrease of pressure. The midnight map of that date showed a low area well defined and central at Salt Lake City, Utah, bounded by the isobar of 29.5, with brisk to high southeast winds at Fort Bridger, Wyoming. It moved very slowly to the southeast on the 10th, and then assumed a retrograde movement to the southwest on the morning of the 11th. After that date it oscillated without any display of energy and remained a low area, without well-defined outlines, until it finally became merged in a storm which had entered Texas from the Gulf of Mexico.

IV.—This area was first observed in the Gulf of Mexico on the 8th, south of Cuba, and passed southward between Capes Catoche and San Antonio. The track of the storm-centre is as closely approximated as the rather meagre vessel reports would permit. It is the only tropical disturbance occurring during the month. On the 12th the centre of disturbance approached Galveston, Texas, where the barometer fell rapidly, and a high northwesterly gale set in, reaching a velocity of fifty-five miles per hour at 10.15 p. m. of that date. It then turned northward and on the 13th lost the marked energy which had hitherto characterized its motion. It filled up by gradual increase of pressure and was merged in the trough of low pressure which extended from Lake Superior to northern Louisiana. In this trough the most energetic disturbance of the month originated, and is herein described as number vi.

The following notes from Signal Service observers are of interest in connection with this storm:

Sanford, Florida: heavy rain began falling at 12.15 a. m. of the 10th and continued until 3.15 p. m. of the 11th; total precipitation, 4.24 inches. The barometer fell slowly during the 10th and rose on the 11th; brisk easterly winds prevailed on both days.

New Orleans, Louisiana: on the 11th a wind-storm from the east began at 8.15 p. m.; maximum velocity, thirty-eight miles per hour from the northeast at 11.35 p. m.; the high wind continued until 4.30 p. m. of the 12th. Considerable damage was done in the city and surrounding country by the high tide, causing numerous breaks in the navigation and drainage canals. In the Parish of Plaquemines, forty miles below the city, the waters from the Gulf were backed up over the rice fields for a distance of thirty-five miles inland. At the Mississippi quarantine station the storm was very severe, the wind blowing a northeasterly gale for thirty-six hours, causing a high tide which broke the levees and flooded many miles of rice plantations and orange groves.

Port Eads, Plaquemines parish, Louisiana: widespread damage was done by the storm of the 11th and 12th. The wind blew hard on the 10th, and by the morning of the 11th had increased in force, attaining at noon the velocity of a high gale. The water of the Gulf was very high on the 10th and continued to rise on the 11th until Port Eads and the surrounding country was completely submerged to a depth of two and one-half feet. On the east side of the river, between Point a la Hache and Port Eads, all crops were almost completely destroyed; the damage in this vicinity is estimated at $200,000.

Galveston, Texas: the barometer fell slowly during the 11th and morning of the 12th, accompanied by brisk northeast winds. During the afternoon of the 12th the wind backed from the north to northwest, and increased in force, attaining at 10.15 p. m. a velocity of fifty-five miles per hour, at the same time the tide was very high and the lower part of the city overflowed although the usual effect of a northwest wind is to lower the water in the bay. After 11 p. m. the wind decreased in force, and at 7 a. m. of the 13th was blowing from the southwest at the rate of sixteen miles per hour. The only damage done at Galveston was to the smaller vessels, several of which were grounded.

See "High tides" in this REVIEW for further notes relative to this storm.

V.—On the afternoon of the 12th an area of low pressure advanced to the southeast from the vicinity of the Selkirk Mountains and moved towards the headwaters of the Missouri. It moved rapidly, attended by rains in the eastern and southern quadrants. By midnight of that date a trough of low pressure extended from the Saskatchewan Valley southeastward to the Gulf of Mexico, while a storm of considerable energy was advancing over Texas, with a secondary depression forming in Kansas. This area occupying the northern part of the trough did not develop much energy inside the limits of observation, but moved northeastward and disappeared during the night of the 13th.

VI.—The elongated area of low pressure, previously described, on the afternoon of the 13th developed a well-defined storm-centre in eastern Kansas, which moved to the northeast with rapidly increasing energy and marked decrease of pressure. On the morning of the 14th it was central at Davenport, Iowa, bounded by the isobar of 29.10, and produced heavy rains in the Lake region, the Middle and Southern States, and the Mississippi Valley. On that date it passed over the Lakes, producing heavy northwesterly gales, and on the 15th moved down the Saint Lawrence Valley, disappearing on the 16th into the Gulf. During its passage over the valley of the Saint Lawrence on the 15th northwesterly gales and heavy rains prevailed in the eastern lake region and the Canadian Provinces. From the Gulf of Saint Lawrence to Lake Erie the barometric gradient was nearly one inch, and from Sandusky, Ohio, to Anticosti, Gulf of Saint Lawrence, the velocity of the wind varied from fifty-three to forty-five miles per hour, accompanied by severe thunder-storms and heavy rains.

The following notes from Signal Service observers will serve to show the severity of this storm:

Cairo, Illinois: during the 13th the barometer fell rapidly and brisk southerly winds prevailed. On the 14th the barometer rose rapidly and high westerly winds set in, maximum velocity thirty-two miles per hour. All railroad trains from northern points arrived late, obstructions having been blown upon the track by the high wind.

Springfield, Illinois: rain, heavy at times, fell during the night of the 13–14th and morning of the 14th. The rain was accompanied by high southwesterly wind, which attained at 6 a. m. a velocity of thirty-four miles per hour.

Chicago, Illinois: during the morning of the 14th the wind was fresh to high, increasing in velocity until between 1 and 2 p. m. it had attained a velocity of thirty-six miles per hour from the southwest. The barometer fell rapidly and at 12.30 p. m. stood at 29.10.

Saint Louis, Missouri: at 4.15 a. m. of the 14th the wind reached a velocity of fifty-two miles per hour from the southwest, and at 11.47 a. m. it blew from the west at the rate of forty miles per hour.

Milwaukee, Wisconsin: the barometer fell rapidly during the early morning and until 11.20 a. m. of the 14th; after remaining nearly stationary until noon it began to rise rapidly. The wind gradually veered from southeast at 7 a. m. to nw. at noon, and at 12.40 p. m. began to blow a heavy gale from the latter direction, continuing until 6 p. m.; maximum velocity forty-eight miles per hour. The gale was very severe on the lakes, driving a number of vessels ashore and doing serious damage to all kinds of shipping.

Grand Haven, Michigan: light rain began at 5.17 a. m. of the 14th and continued, with intervals of heavy rain, throughout the day. Cautionary signals were hoisted at 11.20 a. m. The brisk southerly winds that prevailed during the day at 3.20 p. m. suddenly shifted to the northwest and blew with the force of a gale; maximum velocity fifty-two miles per hour. Numerous signs and telegraph poles were blown down, while shade trees were stripped of branches or uprooted. The gale continued with unabated force throughout the night of the 14–15th and a number of vessels were obliged to go into port for shelter.

Port Huron, Michigan: a gale from the south began at 1.53 p. m. of the 14th and reached its greatest velocity at 3.40 p. m., fifty miles per hour from the southwest. The storm was very severe on the lakes; several vessels that started out before the gale set in were obliged to return to port for safety.

Mackinaw City, Michigan: fresh to brisk east and southeast winds, accompanied by heavy rain, prevailed during the morning of the 14th, at the same time the barometer fell very rapidly, reading 29.35 inches at 7 a. m. and at 3 p. m. 28.93 inches, which is the lowest ever recorded at this station. The wind was perfectly calm from 2 to 3.15 p. m., when it set in from the northwest with great force, accompanied by heavy rain and rapidly rising barometer.

Escanaba, Michigan: on the afternoon of the 14th the wind blew hard from the north and the barometer fell rapidly, reaching 29.13 at 3 p. m.; heavy rain fell during the night of the 13–14th. The storm did no damage in the immediate vicinity of Escanaba, but captains of vessels report a severe gale on the lakes; several barges were sunk on Lake Michigan and five lives lost.

Detroit, Michigan: light and heavy rain fell during the night of the 13–14th and until 11 a. m. of the 14th. The barometer fell very rapidly until 1 p. m., when it began to rise. A southwest gale set in at 9.30 a. m., shifted to west

at 2.30 p. m., reaching a velocity of fifty-two miles per hour at 3.15 p. m. Considerable damage was done throughout the city to shade trees, signs, and chimneys. Telegraph and telephone wires were grounded and all communication was cut off for several hours. Several vessels were blown from their anchorage and damaged to a considerable extent, and a number of steamers injured by being pounded against the docks. The schooner "O. M. Bond," bound from Detroit for Buffalo, laden with twenty-two thousand bushels of wheat, was driven ashore at Eau Point; the vessel and cargo were lost and two men drowned.

Fort Wayne, Allen county, Indiana: a heavy southerly gale prevailed here during the afternoon of the 14th, unroofing a large number of buildings and uprooting trees.

Vevay, Switzerland county, Indiana: rain fell during the morning of the 14th until 8 a. m., at the same time the wind blew a strong gale, attaining a maximum velocity of seventy-five miles per hour at 10.45 a. m. Numerous trees and chimneys were blown down.

Toledo, Ohio: on the morning of the 14th the barometer was low and it continued to fall until 3 p. m., when it began rising rapidly, lowest reading, 29.35, at 3 p. m. Fresh southerly winds prevailed until 8 a. m., when it began to strengthen, and veering to the southwest, increased in force until 2.30 p. m., when it reached a maximum velocity of forty-four miles per hour. During the gale the water was blown out of the Maumee River to such an extent as to lower it seven feet, this is lower than it has been at any time since 1873. Much damage was done to buildings in all parts of the city, and work on all telegraph lines was interrupted.

Columbus, Ohio: the barometer fell steadily during the night of the 13–14th and until 12.30 p. m. of the 14th, when it stood at 29.50. At 1.05 p. m. the wind blew from the southwest with the force of a gale and continued until after midnight; highest velocity forty-five miles per hour between 1 and 2 p. m. Considerable damage was done to trees, frame buildings, fences, etc.

Sandusky, Ohio: rain, very heavy at intervals, began at 6.42 a. m. of the 14th, with rapidly falling barometer. A gale set in at 8.15 a. m. and continued all day, maximum velocity fifty-three miles per hour from the west at 5.20 p. m. During the 15th the wind blew hard from the northwest and the barometer rose rapidly.

Buffalo, New York: on the morning of the 14th the sky was partly overcast with cumulo-stratus clouds moving rapidly from the west, although the surface winds were from the southeast, having backed to that point from the southwest at 8.30 a. m. At 11.20 a. m. rain commenced and continued until 1.20 p. m., with barometer falling about .05 every hour, reaching 29.31 inches at 6 p. m. At 6.30 p. m. the wind, which had been blowing briskly from the south, veered suddenly to the southwest and increased in force, attaining at 8 p. m. the velocity of sixty-three miles per hour, although between 8 and 8.05 p. m. it blew at the rate of seventy miles per hour; for the four hours ending at 11 p. m. it blew at the average velocity of fifty-three miles per hour. This storm was more destructive to life and property than any that has occurred for several years. The water in a creek that flows through the city is reported to have risen seven feet higher than was ever known before, completely submerging a portion of the city and carrying away twenty-five frame houses and drowning several persons. At 8 p. m. the German Music Hall, in course of construction, was damaged to the amount of $20,000, the entire west and southwest walls being blown down. Rain began again at 11.30 a. m. and continued throughout the night. The gale did not begin to decrease in force until 2 p. m. of the 15th, after having reached at 1 a. m. a velocity of fifty-six miles per hour. The 15th continued cloudy, with squalls of rain, rapidly rising barometer, and falling temperature. Snow fell from 11.55 p. m. of the 15th to 12.10 a. m. of the 16th. The storm signals which were hoisted at 11 a. m. of the 14th undoubtedly prevented many disasters to shipping.

Rochester, New York: during the 14th the barometer fell rapidly, and during the early morning brisk to high southerly winds set in; at 9.15 a. m. the wind had increased in force, and between 11 a. m. and noon blew from the south at the rate of forty-four miles per hour. At 9 p. m. the wind veered to southwest and shortly after again increased in force, veering to the west between 10 and 11 p. m.. The gales were accompanied by rain. During the night of the 14–15th the gale continued to veer toward the northwest, attaining a maximum velocity of thirty-eight miles per hour between 12 and 1 a. m. of the 15th. Several buildings were unroofed and otherwise damaged by the high wind.

Parkersburg, Wood county, West Virginia: the gale of the 14th unroofed houses in various places near this town, and at Tygart Creek a large dwelling house and many fences and hay-stacks were blown down. At Point Pleasant the roundhouse on the Ohio River Railroad was demolished.

VII.—The midnight map of the 15th showed a depression of moderate extent developing in northern California, which had probably entered from the Pacific during the afternoon of that date. On the 16th this area, bounded by the isobar of 29.90, moved eastward, and was followed by an area of high pressure central on the Pacific coast. It developed little energy, however, until the afternoon of the 17th, when it became a well-defined depression, bounded by the isobar of 29.8, and central east of Salt Lake City, Utah, and moving slowly over the Rocky Mountains. It extended on the morning of the 18th in a pear-shaped, irregular ellipse to the Gulf of California. On that date the pressure at the centre rapidly decreased to 29.5, with heavy southwesterly winds in Arizona and New Mexico, and southeasterly winds in Kansas and the Indian Territory. Very little rainfall attended its advance eastward on the 18th, and it gradually dissipated on the 19th by increase of pressure under the influence of a depression developing in Minnesota.

VIII.—This area, first noted on the afternoon map of the 19th, appeared as a secondary depression in the northern part of the trough of low pressure in the rear of low area number vii, and extending from the Rio Grande to the Saskatchewan. To the west of this a high area existed with its major axis in a line from the coast of Oregon to Salt Lake City, Utah. This low area first moved northward on the 19th and then curved to the east, followed by the area of high pressure which moved over the central Rocky Mountain region, Kansas, and Nebraska, producing heavy rains in the upper Mississippi valley. On the 20th it moved rapidly eastward, attended with rains in the Canadian Provinces and the Lake region, the centre of disturbance being north of the Saint Lawrence, and on the 21st disappeared eastward beyond the limits of observation, producing heavy rains in the lower lake region and Canada. The passage of this area over the Lake region was accompanied by heavy northwesterly gales.

IX.—An area of high pressure was central over the Ohio Valley, and another over California and Nevada on the afternoon of the 22d. In the northern part of the trough of low pressure which separated these two areas a storm-centre developed and moved to the southeast from the Saskatchewan Valley on that date, producing light rains in Minnesota, Dakota, and Iowa, and heavy thunder-storms in Kansas. The influence of the high area to the eastward somewhat retarded the progress of the storm-centre. The rain-area in front of the depression extended from Manitoba to northern Texas and eastward over the upper Mississippi valley. In the southern quadrant of the storm-centre the thunder-storm area extended from Dakota to the Valley of the Red River on the line of the major axis of the trough of low pressure. On the morning of the 24th the centre of disturbance was north of Lake Superior, and high northwesterly winds prevailed in Dakota and Nebraska, with southerly to southeasterly winds in the Lake region during that day. On the 25th the centre of disturbance drew slowly eastward north of the Saint Lawrence and disappeared beyond the limits of observation.

## NORTH ATLANTIC STORMS DURING OCTOBER, 1886.

*[Pressure in inches and millimetres; wind-force by Beaufort scale.]*

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the proprietors of the "New York Maritime Register," and from other miscellaneous data received at this office up to November 21, 1886.

Fourteen depressions are traced, of which one, number 11, was a continuation of an area of low pressure which first appeared over the North American continent; number 1 was a continuation of ocean depression number 10 traced for September; number 2 continued land depression number xi charted for September; number 3 first appeared in the sub-tropical region north of the West Indies on the 3d and moved slowly northeastward until the 13th, from which date its forward motion was greatly accelerated, and the centre of depression passed to the northward of the British Isles by the night of the 14th or the morning of the 15th. This storm was very destructive on the British and French coasts from the 14th to the 16th, and, by reason of its track across the Atlantic being far to the southward of the generality of storms traced, surmises have been made in maritime circles as to its probable

birthplace. The origin and course of this great storm is, therefore, a matter of special interest.

Numbers 4, 5, and 6 first appeared to the eastward of the Labrador coast and are traced to the northward of the British Isles; number 7 apparently originated and dissipated over the ocean in the vicinity of the thirty-fifth parallel; numbers 8 and 9 were storms of marked energy which passed over the Bay of Biscay during the last half of the second decade of the month; number 10 first appeared south of Greenland and passed east and southeast to the coast of France; number 12 apparently originated south of Newfoundland and circling northeastward disappeared off the British coast; number 13 developed in the neighborhood of the West Indies and reports admit of tracing its track during two days; number 14 first appeared over mid-ocean and is last charted on the 31st to the westward of the British Isles.

The following presents the characteristics of the depressions traced for the present month, as compared with those traced over the north Atlantic for October, 1885.

In October, 1885, fourteen storm-areas appeared, all of which apparently originated over the ocean. One cyclone of great intensity (not charted) appeared suddenly over the English Channel on the 10th, when the barometer fell to 28.90 (734.0), and gales of hurricane force, from w. to nw., occurred over the ocean from W. 25° eastward over the Bay of Biscay to the French coast. Towards the end of the first decade and the commencement of the second severe gales prevailed over the western part of the ocean. During the second decade the pressure was low in the vicinity of the Azores; the data at hand, however, was insufficient to determine the paths of areas of low pressure that may have appeared in that neighborhood. During the last decade of the month areas of low pressure predominated over the British Isles and the ocean east of the twenty-fifth meridian, although during the last five days of that period two depressions appeared over mid-ocean, and one passed northeastward over the western portion.

In October, 1886 the month opened with an area of low pressure central over mid-ocean and one to the southward of Nova Scotia, the two combining to produce generally stormy weather west of the twentieth meridian. The first decade of the month was marked by the development or passage of five areas of low pressure over the ocean, which caused numerous gales and rough weather, save in the vicinity of Newfoundland, where relatively fair weather prevailed after the 3d. In the second decade two storms of great energy developed north of Spain and passed northward beyond the region of observation; two storms, one of which (number 3) has been previously referred to, passed to the northward of the British Isles, and one developed and disappeared over mid-ocean in low latitudes; during this decade the storm conditions were confined principally to the eastern part of the ocean. In the third decade five depressions are traced, all of which, except one (number 13), crossed the ocean in high latitudes.

A general summary of the weather conditions which prevailed over the north Atlantic during the month shows that the storms developed the greatest intensity off the west coast of Europe, from latitude N. 45° to 60°, and east of the thirtieth parallel; over the western portion of the ocean and along the coasts of the United States and the Canadian Maritime Provinces no storm of special energy occurred after the first two days of the month. The tropical hurricane which entered the Gulf of Mexico at the close of the first decade and commencement of the second was very destructive and exceptionally severe in its character, as is indicated by special reports received from observers at Havana and Key West, which, together with the reports of ship-masters who encountered the storm, will be found herein.

The following are brief descriptions of the depressions traced:

**1.**—This storm was central on the 1st in N. 48°, W. 29°, with central pressure about 29.40 (746.7), rain and fresh gales; whence it moved east until noon of the 2d, then circled north off the west coast of Ireland and apparently passed to the westward during the afternoon of the 3d and united with, or was absorbed by, depression number 2 on the 4th. During the 2d the depression was attended by fresh to hard gales and rain, which conditions continued on the 3d and 4th, although during the latter dates a loss of energy was apparent.

**2.**—This storm passed off the coast of the United States in the vicinity of Boston during the early morning of the 1st, with central pressure about 29.40 (746.7), fresh to strong gales and rain; by the morning of the 2d it had moved northeast over Newfoundland, attended by fresh to hard gales and rain; during the 3d it moved east, with central pressure about 29.00 (736.6), and on the 4th passed southeast to N. 49°, W. 18° by noon of the 5th, with an appreciable loss of energy; during the next two days the depression moved east and disappeared in the direction of the French coast on the 7th.

The following special reports have been received relative to this storm:

The s. s. "Etruria," Capt. T. Cook, commanding, had a storm on the 1st; wind veered from se. to nw.; lowest barometer, 29.23 (742.4), at 1.40 p. m., in N. 42° 50′, W. 60° 20′. Capt. G. Gerlach, commanding the bark "Pillan," reports: "1st, in N. 42° 28′, W. 62° 30′, 4 a. m., fresh southerly winds; 8 a. m., wind increasing; 10.15 a. m., storm-centre apparently to the eastward, sea very high, weather very thick, with rain, one of the sails carried away; 12 noon, barometer rising rapidly, wind continued in strong gusts from the n. until 1.30 p. m., when it shifted to w. and calmed down."

Capt. W. M. Rittig, commanding the s. s. "City of Washington," reports: "1st, fresh gale from sw. veering to n. during, and to easterly following, the disturbance; lowest barometer, 29.96 (761.0), at 6.30 a. m., in N. 37° 40′, W. 74° 50°. Before this blow noticed peculiar-shaped, funnel-like clouds hanging over Cape Hatteras; one hour after the wind freshened from w., hauling to nw. and ne., attended in the easterly quarter by hard squalls and heavy rain; after the gale fine weather and ne. winds." The s. s. "River Ettrick," Capt. John Black, commanding, on the 1st, in N. 35° 10′, W. 74° 57′, had a fresh gale from n. veering to ne. The barkentine "Lydia," Capt. G. Lowery, commanding, had a hurricane on the 1st; wind veered from ese. to nw.; lowest barometer at 1 p. m., in N. 45° 10′, W. 62° 15′. The s. s. "Adriatic," Capt. H. Parsell, commanding, had a whole gale on the 1st; wind veered from s. to nw.; lowest barometer, 29.16 (740.7), at 9.30 a. m., in N. 42° 0′, W. 63° 15′. The s. s. "Zaandam," Capt. H. C. von der Zee, commanding, on the 3d, had a storm from sse. veering to nnw.; lowest barometer, 29.70 (754.4), at 11 p. m., in N. 48° 50′, W. 38° 7′.

The s. s. "St. Ronans," Captain Campbell, commanding, on the 4th, in N. 48°, W. 29°, had a very severe storm, blowing for some time with hurricane force, with mountainous seas, which broke on board with great force, filling the decks, forecastle, cabin, and wheel-house; the steam steering chains were carried away and engines were slowed, with head to the sea, until new chains were rove. Capt. Alex. McKay, commanding the s. s. "Catalonia," reports: "4th, in N. 48° 46′, W. 38° 42′ (at noon), experienced the first of a nw. gale; 2 a. m., wind shifted suddenly from sw. to nw. in a heavy squall; 8 a. m., wind nw., force 8, high nw. sea; noon, wind nw., force 8, high nw. sea; 4 p. m., moderating, wind nw., force 6, sea nw., rough; lowest barometer, 29.98 (761.5), at 8 a. m."

**3.**—Vessel reports of the 1st and 2d indicated the presence of a cyclonic area over the western portion of the Caribbean Sea, but were not sufficiently numerous to accurately locate its centre; by the 3d, however, the depression had passed to the northward of the West Indies in the direction of the east coast of Florida, and was central on the morning of that date in N. 29°, W. 76°, with hard gales to the north and west; from this position it moved slowly northeastward to N. 37°, W. 65° by the 7th, accompanied by disturbances of pronounced strength; from the 7th to the 13th it advanced slowly in a generally north of east direction to N. 44°, W. 43°; during this period

its probable track is given, as reports, while too scattering to accurately locate its centre each day, still furnish sufficient data to justify the approximate tracing of the storm's path. During the 13th and 14th the depression moved rapidly northeastward, accompanied by very severe and destructive disturbances over a large area of the ocean, and disappeared north of the British Isles beyond the region of observation after the 14th. The storm first assailed the south and west British coasts on the night of the 14th, and raged as a destructive storm on the British and French coasts from the 14th to the 16th.

The following special reports indicate the characteristics of this cyclone:

Capt. Charles Acocks, commanding the bark "Mary," reports: "2d, in N. 31° 45′, W. 71° 14′ (at noon); 6 p. m., light breeze from ne., sea s.; 6.30 p. m., wind and sea increasing; 8 p. m., strong gale, sea mountainous from ne.; midnight, hard easterly gale, and black, cloudy weather. 3d, in N. 32° 35′, W. 72° 10′ (at noon); very heavy ne. sea, hard ne. gale, with heavy rain." The bark "Mary," on the 5th, in N. 34° 53′, W. 74° 23′ (at noon); at daylight had heavy squalls from nw. to ene.; noon, heavy clouds from se., wind ne. to nne.; 4 p. m., wind n., heavy lightning to the se. and e.; midnight, fresh to strong gale, with heavy ne. sea.

Capt. E. Smit, commanding the s. s. "Pietre de Conick," reports: "13th, in N. 48° 18′, W. 25° 24′ (at noon); 8 p. m., a strong gale began from sse, veered to s., sw., and w., and continued with increasing force until 6 a. m. of the 14th, in N. 47° 50′, W. 28° 12′ (at noon), when it veered to wnw. and blew a perfect hurricane from 6 a. m. to 8 a. m., the barometer having fallen to 28.90 (734.0); after 8 a. m. the gale began to moderate." Capt. J. H. Taat, commanding the s. s. "Edam," reports: "14th, in N. 50° 12′, W. 17° 36′ (at noon); from 9 a. m. to noon the wind increased to storm force; barometer fell to 29.00 (736.6); wind went to sw., with very wild sea and rain; at noon the barometer rose to 29.27 (743.4); during the afternoon the wind was from sw., with high, wild sea; 4 p. m., wind increased to hurricane, flying to nw.; barometer 29.42 (747.3). The sea was then frightful, a nw. sea running into a sw. sea; wind continued, varying from nw. to n.; barometer rose at night to 29.70 (754.4)."

Chief Officer Kinning, of the s. s. "Roman," Capt. D. Williams, commanding, reports: "14th, in N. 50° 53′, W. 26° 38′ (at noon); wind backed to s. at 1 a. m., and increased in force, with lightning and heavy rain; 5 a. m., backed to se., and veered to w. at 8 a. m., with rapidly falling barometer (lowest 28.80 (731.5) at 9 a. m.) and a furious gale from w. and very high seas; 10 a. m., wind veered to nw. and at noon to ne.; at 1 p. m. backed to n. and wnw., and continued a hard gale all day, with very high seas." Chief Officer Osienak, of the s. s. "Venetian," Capt. W. H. Trant, commanding, reports: '14th, in N. 51° 8′, W. 22° 38′ (at noon); moderate breeze in a. m. from sw., backing to s.; 8 a. m., increased to moderate gale, with rain; noon, strong gale s.; 2 p. m., terrific gale, with violent squalls; 4 p. m., veered to nw., and continued blowing strong gale from nw. through the 15th, in N. 51° 11′, W. 26° 51′ (at noon), with squalls, and heavy rain and hail squalls in the evening; lowest barometer, 28.72 (729.5), at 8 a. m. of the 14th."

Mr. Edward King, observer on the s. s. "Umbria," Capt. W. McMickan, commanding, reports: "13th, in N. 49° 25′, W. 35° 10′ (at noon), wind fresh from s., with heavy confused sea sw.; 6 p. m., in a squall of heavy rain the wind shifted suddenly to nw., n., and ne., increasing to force 11, barometer having fallen rapidly to 28.95 (735.3); gale moderated on 14th and backed to westerly." The s. s. "Normandie," Capt. G. de Kersabiec, commanding, on the 13th, had a whole gale from ne., backing to nw.; lowest barometer, 29.07 (738.4), at 4.50 p. m., in N. 48° 30′, W. 36° 30′. This gale lasted only four hours, but the wind for two hours was at force 11, and the barometer fell very rapidly. Third Officer Prager, of the s. s. "Donau," Capt. H. Supmer, commanding, furnishes the following data descriptive of the disturbance encountered by that vessel during the 13th:

| Greenwich time. | Barometer. | | Wind. | | Latitude. | Longitude. | Remarks. |
|---|---|---|---|---|---|---|---|
| | Inches. | Millimetres. | Direction. | Force. | | | |
| *Hours.* | | | | | ° ′ | ° ′ | |
| 0.30 | 29.47 | 748.5 | e. by n. | 8 | ..... | ..... | Heavy rain showers. |
| 1.30 | 29.38 | 746.2 | e. by n. | 8 | ..... | ..... | |
| 2.30 | 29.29 | 744.0 | nne. | 8 | 47 17 | 40 24 | |
| 3.30 | 29.20 | 741.7 | ese. | 5 | ..... | ..... | Heavy rain showers. |
| 4.30 | 29.16 | 740.7 | se. | 5 | ..... | ..... | High cross sea from ne. to se.; heavy rain showers. |
| 5.30 | 29.10 | 739.1 | e. by n. | 6 | ..... | ..... | |
| 6.30 | 29.04 | 737.6 | e by n. | 5 | 47 27 | 39 27 | |
| 7.30 | 29.00 | 736.6 | ne. by e. | 3 | ..... | ..... | |
| 7.55 | 28.89 | 733.8 | ne. | 9 | ..... | ..... | |
| 8.30 | 29.00 | 736.6 | nne. | 10 | ..... | ..... | |
| 9.30 | 29.04 | 737.6 | n. | 11 | ..... | ..... | Very heavy sea from n. |
| 10.30 | 29.11 | 739.4 | n. | 11 | 47 36 | 38 33 | |
| 11.30 | 29.26 | 743.2 | n. by w. | 10 | ..... | ..... | A long, high swell from sw. |
| 12.30 | 29.38 | 746.2 | n. by w. | 10 | ..... | ..... | |
| 13.30 | 29.48 | 748.8 | nnw. | 9 | ..... | ..... | |
| 14.30 | 29.54 | 750.3 | nnw. | 9 | 47 33 | 37 30 | Broken sky. |
| 15.30 | 29.62 | 752.3 | nw. by n. | 9 | ..... | ..... | Swell from sw. increasing. |
| 16.30 | 29.70 | 754.4 | nw. by n. | 9 | ..... | ..... | Very heavy and cross sea from n. and sw. |
| 17.30 | 29.71 | 754.6 | nw. | 8 | ..... | ..... | |
| 18.30 | 29.72 | 754.9 | w by n. | 7 | 47 49 | 36 20 | Decks constantly filled with water. |
| 22.30 | 29.83 | 757.7 | ..... | ..... | 47 52 | 35 9 | |

Second Officer Francis Potts, of the s. s. "British Crown," Capt. Archibald Smith, commanding, reports having encountered a strong gale, force 9, on the 14th; lowest barometer, 28.65 (727.7), at 11 a. m., in N. 51° 14′, W. 22° 5′; the gale was accompanied by very heavy seas. The s. s. "Erin," Capt. J. Robinson, commanding, on the 14th and 15th, in N. 49° 23′ W. 10° 0′ to N. 49° 56′, W. 4° 19′, had strong w. to sw. gales, with squalls of hurricane force. The s. s. "Marengo," Capt. W. Abbott, commanding, on the 14th had a whole gale from nw. to nne.; lowest barometer, 28.76 (730.5), at 1 a. m., in N. 49° 20′, W. 33° 24′.

**4.**—This depression first appeared on the 6th, in N. 57°, W. 34°, and, moving rapidly eastward, passed to the northward of the British Isles during the 7th. This storm apparently possessed considerable force, but passed too far to the northward to cause serious disturbances in the trans-Atlantic tracks.

**5.**—This depression followed closely after number 4 and pursued a similar course during the 7th, 8th, and 9th; its influence, however, was more widely extended, and hard gales were encountered during those dates as far south as the forty-fifth parallel.

The following special reports have been rendered relative to this storm:

The s. s. "Prussian," Capt. A. McDougall, commanding, on the 7th had a moderate gale from nw.; lowest barometer, 29.46 (748.3), at 12 noon, in N. 51° 20′, W. 37° 48′. Chief Officer Bennington, of the s. s. "Martells," Capt. F. E. Jenkins, commanding, reports: "8th, in N. 50° 11′, W. 26° 35′ (at noon); 8 p. m., a fresh gale began from w., with high seas and squalls; barometer 29.39 (746.5) at noon." The s. s. "Celtic," Capt. B. Gleadell, commanding, had a strong gale on the 9th and 10th, from sse. veering to nw.; lowest barometer, 28.93 (734.8), at 5 a. m. of the 9th, in N. 51° 28′, W. 13° 10′.

The tropical hurricane which is traced as depression number iv was first indicated by reports of the 7th, and moved slowly northwestward from the Caribbean Sea, passing over, or in close proximity to, the western extremity of Cuba during the early morning of the 9th; thence passing northwest into the Gulf of Mexico during the 9th, 10th, and 11th it circled westward to the vicinity of Galveston, Texas, during the 12th, and, passing northward, dissipated over Louisiana during the 13th. This storm is reported as having been one of the severest ever encountered in the Gulf of Mexico.

The following special dispatch was sent to the Chief Signal Officer from Havana on the 8th:

Barometer 29.89 (759.2), wind east, thirty-five miles an hour, with light rain. Storm central southwest from this station, moving northwest; probably recurving.

Rev. Benito Viñes, S. J., director of the Belin College Ob-

servatory, Havana, Cuba, has collected and forwarded to the Chief Signal Officer information relative to this storm, as follows:

HAVANA, *October* 7, 1886—10 a. m.

Since yesterday indications of a cyclonic movement have been observed at sea, but up to the present hour it has shown itself of very small intensity; the centre of the storm is in the third quadrant to the ssw.

The storm is likely to make a recurve and cross the western portion of the island, in which case it is probable that we will have violent gusts of wind with rain from the east.

OCTOBER 8TH—Noon.

During last evening and night the storm increased somewhat in intensity, and has, as it appears, passed us by the wsw., so it is at this time crossing the western extremity of the island.

In Vuelta-Abajo it will be felt more severely than at Havana, in the form of heavy gusts of wind with repeated squalls from the e., moving s. and ssw.

The storm, it seems, is making a recurve, and it is yet likely its influence will be felt here during the evening and night with severe gusts of wind and rain from the second quadrant.

OCTOBER 9TH—10 a. m.

During last evening and night the entire storm advanced slowly, passing by the west, which will prove, it seems, that the recurve entered the extreme west of the island and passed parallel with Havana, causing a vortex at this time at about one hundred and fifty miles distance from here.

Since my last communication the barometer fell steadily up to 4 a. m. Sunday, the 10th, at which hour it reads 29.71 (754.5), corrected and reduced to sea-level, with gusts of wind from sse. to s., reaching, at times, fifty-six miles (twenty-five metres) per hour; sky obscure; squally, with light rain; wind presently settled from the s., oscillating slightly to the ssw., diminishing little by little in intensity.

In consequence, it is of much importance to note that the cyclonic winds during the storm have been greatly converging, a supposition which I entertained from its commencement.

During the whole day yesterday the sea rose high, with heavy swells from the nw., and it is noteworthy that the sea-swell increased up to last night.

*The weather in Pinar del Rio.*

The general government received yesterday the following telegram from the civil governor of Pinar del Rio, furnishing an account of the last storm which passed over those provinces:

"PINAR DEL RIO, *October* 13, 1886—8.10 a. m.

"I have been informed by the civil guard of San Luis that on the 9th they went out, accompanied by the local authorities, to examine the districts in the proximity of rivers, in order to save those who may be in danger, from there they will go to the shore of "Punta del Cartas" to extend similar services.

"In connection with the foregoing notice the following cards were received from two different towns in 'Vuelta-Abajo:'

"'VIÑALES, *October* 11, 1886.

"'It seems almost impossible that the calamities in Vuelta-Abajo succeed one another with such frequency. On Thursday the 7th instant, at 5 p. m., a breeze set in, which though not causing particular anxiety at the time had a bad look; later in the evening it changed to south, and continued with various gusts; people commenced to seek refuge under neighboring shelters; the wind was accompanied by heavy showers and the roads became impassable. At 9 p. m. the wind and rain grew heavier; we passed the night in watching and opening the door for those who were looking for more secure lodgings.

"'Unfortunate persons who in the recent cyclone lost many guano huts and tobacco houses had not recovered from their last misfortunes before this one to-day overtook them. Many of the handsome young tobacco plants, which were very luxuriant and near to enter into seed, were destroyed and annihilated by the heavy rain and wind, as a consequence there is nothing left of the actual tobacco crop for transplanting.

"'SABALO, *October* 11, 1886.

"'A cyclone, with heavy wind and rain, commenced during the 7th and ended yesterday at daybreak, devastating the tender tobacco plants, food of all kinds of the little left by the previous storms; various animals were drowned, and buildings blown over. The winds commenced by the north and ended by the west, the strongest being from the south. The state in most parts of Vuelta-Abajo is very deplorable, people being without any resources whatsoever to feed their children upon.

"'According to information received from Guane, great damage has occurred from the overflow of Cuyaguateje River. No information as to personal injury has been received, and I do not think there has been any.'"

**The Signal Service observer at Key West reports:**

On the 8th cyclonic indications were observed; the weather was threatening and hazy, with very brisk east winds, having a tendency to be squally; barometer falling slowly; light sprinkling or misty rain. 9th, rain in heavy squalls up to 10.40 p. m.; thunder-storm in the evening, moving from se. to nw.; wind easterly, with gale velocity at times; in the evening two gusts of velocity, sixty miles; barometer falling all day to 29.79 (756.7) at 11 p. m.; wind hauled slowly from e. to se. Notifications of a cyclonic disturbance were posted in prominent places and precautionary measures were taken to insure the safety of shipping. 10th, gale continued, with wind hauling to s. and se., in heavy squalls; to the ne. and e. clouds were broken, while to the s. and sw. they were very heavy; barometer 29.72 (754.9) at 7 a. m.; between 1 and 2 p. m. wind hauled to s. and weather brightened; barometer remained stationary until 6 p. m., after which it rose and the weather cleared.

The s. s. "Professor Morse" encountered a hurricane on the 8th in N. 20° 30′, W. 85° 20′, during which oil bags were used on the weather side with good effect.

Capt. Frank Stevens, commanding the s. s. "Manhattan," reports: "Gale came on at 1. a. m. of the 9th, from nne., with very heavy squalls and slowly falling barometer. Ship on Campeche Bank in eighteen fathoms of water. Kept ship on the port tack under storm try-sail; wind backing very slowly to northward, and continued to back around to sw.; at 4 p. m., in N. 22° 15′, W. 87° 18′, the barometer read, lowest, 29.26 (743.2). 10th, 11.20 a. m., kept off on course ene.; very heavy sea running from all points of the compass, with ugly, threatening-looking weather; glass going up slowly all the time; arrived at Havana 2.30 p. m., where very heavy seas were breaking on the shores."

Captain Burrows, commanding the s. s. "San Marcos," furnishes the following report: "9th, 5.40 p. m., in N. 26° 0′, W. 86° 30′, barometer 29.90 (759.4), and falling; wind ne. by n., force 5; sky obscured and cloudy; heavy sea running from se. as well as from the quarter of the wind; ship sailed from above position thirty-six miles e. by s. ½ s. at 2 a. m. of the 10th, at which time barometer indicated 29.60 (751.8) and wind had increased and rain became constant; from thence the drift of the ship was about three miles an hour sw; barometer fell rapidly to 29.10? (739.1)? at 10.40 a. m., and wind had hauled to n., blowing with irresistible force for about two hours. At 12.30 p. m. of the 10th barometer 29.15 (740.4); wind a heavy gale only, blowing from nw. for about four hours, then wsw. and sw. for about eight hours, or until 8.40 p. m., when clouds broke somewhat and wind went into a gentle gale, subsiding rapidly."

Capt. M. Garson, commanding the s. s. "Madrid," reports: "10th, 5 a. m., barometer 29.26 (743.2), wind ese., force 10; 7 a. m., in N. 24° 45′, W. 84° 22′, barometer 29.08 (738.6), wind se., force 11; 9 a. m. to noon, wind in gusts, blowing at times with hurricane force; air thick—not possible to see twice the length of the ship; swell from ese. and s., in waves of thirty feet in height; at noon the barometer stood 29.16 (740.7), with wind s., force, 12; wind began to moderate from s. shortly after midday. At 7 a. m. the engines were stopped and were not started for sixteen hours. Our reasons for this were twofold, viz., to allow the centre of the storm to get out of our track, and to prevent the risk of breaking down the engines by 'racing' in a very disturbed and irregular sea." The s. s. "El Paso," Capt. H. S. Quick, commanding, on the 10th, in N. 27° 0′, W. 87° 40′, had a gale from ene.; barometer 29.75 (755.6); 11th, in N. 27° 0′, W. 86° 15′, wind of hurricane force, backing slowly from ene. to sw.

The s. s. "Colorado," Captain Daniels, commanding, on the morning of the 11th encountered a terrific hurricane from the ne., which continued to rage for nine hours, when the wind changed to nw. and continued in that direction for ten hours; morning of 12th wind changed to east and continued for ten hours, when it came from an easterly point with a velocity of ninety to one hundred miles an hour, raising a terrific cross sea; barometer 29.05 (737.9), in N. 27° 10′, W. 89° 0′. Capt. W. M. Rettig, commanding the s. s. "City of Washington," reports: "On the 13th, while lying in harbor at Vera Cruz, experienced a peculiar undulating swell from se.; ship broke stern moorings."

**6.**—This depression first appeared south of Greenland in W. 45° on the 10th, and, passing rapidly north of east, disappeared beyond the region of observation after the 11th. The storm was possessed of great energy and influenced the weather conditions to the fortieth parallel, and exhibited barometric pressure below 29.00 (736.6).

The following special reports concerning this storm are at hand:

Captain Bakker, of the s. s. "W. A. Scholten," reports that on the 10th, in about N. 48°, W. 38°, he encountered a whole west-

erly gale blowing about seventy miles an hour. Capt. G. de Kersabiec, of the s. s. "Normandie," reports having encountered a whole westerly gale lasting from midnight of the 9th to the 12th; lowest barometer, 29.26 (743.2), in N. 50° 15′, W. 26° 45′. Captain Vogelgesang, of the s. s. "Rhaetia," reports a fresh westerly gale from the 9th to the 12th; lowest barometer, 28.76 (730.4), at 4 a. m. of the 11th, in N. 56° 1′, W. 24° 38°. Capt. W. McMickan, of the s. s. "Umbria," reports a whole westerly gale, increasing to force 11, from the 11th to the 13th; lowest barometer, 28.95 (735.3), at 8 p. m. of the 11th, in N. 51° 0′, W. 18° 30′.

**7.**—This storm apparently developed over mid-ocean and is first charted on the 14th in N. 35°, W. 53°, from which position it passed eastward to N. 35°, W. 47° by the 15th, accompanied by strong gales, and exhibiting central pressure about 29.50 (749.3). No special reports have been received relative to this depression.

**8.**—This depression first appeared on the 16th in the Bay of Biscay and passed to the west coast of England by the 17th, whence it moved beyond the limit of reports. The depression was accompanied by heavy gales and rain, and vessel reports show that severe weather was experienced over the British Isles and along the French coast during its passage, with barometric pressure ranging below 29.00 (736.6).

**9.**—This depression, following closely after numbers 3 and 8, caused a continuation of stormy weather off the west-central coast of Europe. The storm apparently advanced from the west and entered the Bay of Biscay on the 19th, whence it probably passed northeastward. While not as energetic as the depression (number 8) which preceded it, this storm caused violent gales off the French coast during the 18th and 19th.

**10.**—This depression first appeared over mid-ocean on the 20th in N. 56°, W. 33°, with central pressure about 29.60 (751.8), and moved eastward to N. 57°, W. 25° by the 21st, with an appreciable fall in pressure. By the 22d it had moved southeast to N. 54°, W. 17°, whence it passed to N. 48°, W. 9° by the 23d, during which date it disappeared in the direction of the French coast. The depression was accompanied throughout its course by fresh to strong gales and rain.

The following special reports have been received relative to disturbances encountered during its passage:

Captain Dunlap, of the s. s. "Manitoban," reports: "20th, in N. 51° 53′, W. 32° 24′ (at noon), a moderate gale began from w. at 8 a. m., veeing to nw. and increasing to strong gale at midnight, with heavy squalls, and continued in a. m. of the 21st, with hard squalls and rain." Capt. T. H. Fox, of the s. s. "Istrian," reports: "20th, in N. 51° 20′, W. 26° 0′ (at noon), moderate to fresh westerly gales during the 20th and 21st."

**11.**—This storm was a continuation of land depression number viii and passed off the coast of Labrador on the night of the 21st. During the 22d it moved northeastward beyond the region of observation, without evidence of special energy.

**12.**—This storm apparently originated to the southward of Newfoundland and was central on the 24th in N. 45° W. 49°, whence it moved northeast to N. 58° W. 30° by the 27th, after which it passed eastward and disappeared north of the British Isles after the 28th.

The following reports indicate the general character of the disturbances encountered during the passage of this depression:

The s. s. "Istrian," on the 24th, in N. 46° 30′, W. 46° 19′ (at noon), had a strong gale beginning at 8 p. m. from nnw., with high seas; barometer 29.85 (758.2) at 9 a. m.; the ship pitched in a most violent manner, taking heavy seas on board. The s. s. "Egypt," Capt. J. Sumner, commanding, on the 25th and 26th, had a whole gale from sse., veering to nw.; lowest barometer, 29.45 (748.0), at 9.45 a. m. of the 26th, in N. 48° 33′, W. 41° 7′. Capt. H. Parsell, of the s. s. "Adriatic," reports having encountered a whole gale on the 25th and 26th, from sse., veering to nw.; lowest barometer at 6.30 a. m. of the 26th, in N. 48° 40′, W. 41° 0′.

Capt. G. Moody, of the s. s. "State of Georgia," reports: "Had a whole gale on the 26th and 27th from sse., veering to nw.; lowest barometer, 28.76 (730.5), at 11 p. m. of the 26th, in N. 53° 51′, W. 30° 11′. We did not have the force of wind that the fall of the barometer would indicate, but had a terrible sea for two days after its passage. The wind shifted quickly but never exceeded force 9, and the barometer jumped up with the shift of the wind."

**13.**—This depression is first charted in N. 25°, W. 67° on the 23d, although scattering vessel reports indicated the presence of a cyclonic disturbance in the vicinity of Hayti on the 22d. The storm moved northeastward during the 23d and 24th, after which its course cannot be traced, owing to an absence of reports.

The following reports show the character of this depression and the disturbances attending it:

Capt. A. Alexander, commanding the s. s. "L. & W. Armstrong," reports: "22d, in N. 21° 11′, W. 64° 20′ (at noon); at 22 hours, barometer falling slowly; heavy cloud bank lying low from se. to ssw.; noon, barometer 29.70 (754.4); wind sse., force 6. 23d, in N. 23° 50′, W. 64° 54′ (at noon); 3 hours, barometer 29.60 (751.8); wind force 6 to 7; sea rising, rain squalls; 5 hours, heavy rain squalls, with thunder and lightning; barometer falling slowly; wind force 7; sea high, but regular. 10 hours, barometer 29.51 (749.5); wind sse., force 7; heavy sea and squally. 12 hours, wind sse., force 7 to 8; heavy rain keeping the sea down; barometer 29.50 (749.3). 15 hours, barometer 29.40 (746.7); wind sse., force 8 to 9; sea high, but regular; 15 hours 20 minutes, after a very heavy rain squall, with thunder and lightning, the wind hauled to sw. after a few moments lull. We had been steering north, hoping to clear the storm-track; now we had to steer ne., finding the se. sea dangerous; at 16 hours 30 minutes, hove ship to on starboard tack; barometer 29.30 (744.2); 18 hours, slight breaking away of clouds to the eastward, a heavy, dark gray bank of clouds in the westward, extending from s. to wnw.; clear overhead; barometer rising; wind hauled to ssw. and w. and barometer rose slowly; sea going down, and wind decreasing."

A. L. Shaube, mate of the bark "Essex," Captain Hall, commanding, reports: "On the 23d, in N. 26° 17′, W. 64° 58′ (at noon), had a strong gale from ese., with rain and squalls; wind backed to ne. at 8 p. m., with heavy rain squalls, and moderated at midnight." H. O. Marshall, observer on the ship "Magellan," Capt. E. S. Manion, commanding, reports: "24th, in N. 27° 49′, W. 62° 31′, a heavy gale from e. to ne.; barometer 29.45 (748.0) to 29.80 (756.9); lightning all around the compass; gale lasted, with heavy rain and high sea, twenty-four hours."

Mate Oliver Anderson, of the bark "Lilian B. Jones," Capt. E. F. Petrie, commanding, reports: "October 25th, in N. 25° 31′, W. 58° 7′ (at noon); at 2 a. m. a brisk gale began from ssw.; increased at 1 p. m. to hard gale ssw., with heavy seas; hove ship to; 5 p. m., heavy squall struck ship and hove her on beam ends; hard gale continued, shifting to n. at 9 a. m. of 26th, in N. 25° 38′, W. 58° 33′ (at noon), and continued a brisk gale till midnight, then moderated; lowest barometer, 29.78 (756.4), at 4 p. m. of the 25th." Captain Arnold, of the s. s. "Yorkshire," experienced a strong gale from ne., backing to wsw., on the 24th, in N. 34° 27′, W. 63° 0′.

**14.**—This depression first appeared over mid-ocean on the 29th and circled northeast to N. 55°, W. 19° by the 31st. The storms accompanying this depression were very severe, as is shown by the following special reports:

Capt. R. H. Hughes, of the s. s. "Nova Scotian," reports: "29th, 10 p. m. (Greenwich mean time), in N. 52° 10′, W. 23° 4′, commenced hard squalls from sw.; strong gale during 29th, 30th, and 31st, from sw. to nw.; lowest barometer, 29.15 (740.4), at 9 a. m. of the 30th, in N. 52° 10′ W. 26° 50′." Capt. K. Doyle, of the s. s. "Stockholm City," reports a westerly storm of hurricane force from the 29th to 31st; lowest barometer, 29.70 (754.4), at 12 midnight of the 29th, in N. 48° 31′, W. 36° 14′. Capt. D. Meyer, of the s. s. "Hermann,"

reports a whole gale from sw. to nw.; lowest barometer, 29.45 (748.0), at 8 p. m. of the 31st, in N. 49° 27′, W. 22° 13′."

Capt. W. Willegerod, of the s. s. "Trave," had a strong westerly gale on the 31st; lowest barometer, 29.57 (751.0), at 4 a. m., in N. 49° 34′, W. 24° 0′. Capt. C. W. Kennedy, of the s. s. "Germanic," reports a strong gale on the 30th and 31st; lowest barometer, 29.29 (744.0), at 10.30 a. m. of the 31st, in N. 51° 32′, W. 21° 30′. Chief Officer Miller, of the s. s. "Scandinavian," Capt. John Park, commanding, reports a strong gale from s. veering to nne. and backing to w. on the 31st; lowest barometer, 29.22 (742.2), at noon, in N. 54° 21′, W. 18° 1′.

### OCEAN ICE.

On chart i are also exhibited the eastern and southern limits of the region within which icebergs and field ice have been reported during October, 1886. These limits have been determined from reports furnished by shipmasters, and from trustworthy data published in the "New York Maritime Register" and other newspapers.

During this month the easternmost ice was encountered on the 28th, in N. 46° 03′, W. 46° 37′, by the s. s. "Etruria," and the southernmost ice reported was observed on the 5th, in N. 41° 34′, W. 49° 43′, by the s. s. "Borderer."

The icebergs reported were, in each instance, isolated, and, while they were encountered within a considerable area, the aggregate number observed was small, although in excess of the average for the month as determined from reports for the three preceding years.

A comparison with the chart for the preceding month (September, 1886), shows the number of icebergs observed to be about the same, although the area covered by ice reported during that month was much smaller, the southern limit being five degrees further north and the eastern limit about two degrees further west.

The following table shows the comparison between October, 1886, and the three preceding years:

| Southern limit. | | | Eastern limit. | | |
|---|---|---|---|---|---|
| Month. | Lat. N. | Lon. W. | Month. | Lat. N. | Lon. W. |
| | ° ′ | ° ′ | | ° ′ | ° ′ |
| October, 1883 | 46 56 | 46 22 | October, 1883 | 46 56 | 46 22 |
| October, 1884 | near Cape Race | | October, 1884 | 46 56 | 50 55 |
| October, 1885 | 48 21 | 47 13 | October, 1885 | 48 21 | 47 13 |
| October, 1886 | 41 34 | 49 43 | October, 1886 | 46 03 | 46 37 |

Icebergs were reported during the month, as follows:

1st.—The bark "Fluorine," at 7 p. m., passed an iceberg in N. 50° 48′, W. 49° 30′.

3d.—The s. s. "Buenos Ayrean," in N. 52° 26′, W. 52° 20′, at noon, observed a large iceberg, sse., fifteen miles.

5th.—The s. s. "Borderer," at 8.30 a. m., in N. 43° 39′, W. 49° 7′, passed to the south of a large iceberg about three hundred feet high; also passed a large iceberg in N. 41° 34′, W. 49° 43′, which affected the temperature of the water twelve degrees at a distance of ten miles.

16th.—The s. s. "Hibernian," at 1.45 p. m. (Greenwich mean time), in N. 48° 18′, W. 48° 57′, passed an iceberg of moderate size.

17th.—The s. s. "Toronto," at 8.20 p. m., in N. 52° 30′, W. 52° 0′, passed an iceberg.

18th.—The s. s. "Toronto," at 6 a. m., in N. 51° 53′, W. 55° 2′, passed an iceberg.

20th.—The s. s. "Edam," in N. 47° 51′, W. 47° 0′, passed a large iceberg about one hundred and twenty feet high and twelve hundred feet long.

27th.—The s. s. "Egypt," at 2.30 p. m., in N. 46° 20′, W. 47° 2′, passed an iceberg.

28th.—The s. s. "Etruria," at noon, in N. 46° 03′, W. 46° 37′, passed an iceberg with two peaks about one hundred and fifty feet high.

### FOG.

The following table shows the limits of fog-areas encountered on the north Atlantic Ocean during October, 1886, as reported by shipmasters:

| Dates. | Vessel. | Entered. | | Cleared. | |
|---|---|---|---|---|---|
| | | Lat. N. | Lon. W. | Lat. N. | Lon. W. |
| | | ° ′ | ° ′ | ° ′ | ° ′ |
| October 17th | S. S. "Venetian" | 49 24 | 38 30 | ..... | ..... |
| October 17–18th | S. S. "Bothnia" | 49 58 | 31 50 | 48 23 | 39 4 |
| October 24th | S. S. "Galileo" | 48 28 | 35 4 | seven hours. | |
| October 28th | S. S. "Istrian" | 42 29 | 56 9 | at Boston. | |
| October 30th | S. S. "Galileo" | 42 27 | 66 10 | fourteen hours. | |

In above instances fog was encountered with south to east winds.

### SIGNAL SERVICE AGENCIES.

Signal Service agencies have been established in the Maritime Exchange buildings at New York City and Philadelphia, and in the Custom-House, Boston, where the necessary blanks and other information will be furnished to shipmasters.

In pursuance of the arrangements made with the Meteorological Office of London, England, there were cabled to that office from New York during October, 1886, four reports concerning storms and icebergs encountered by vessels in the Atlantic west of the forty-fifth meridian. One message was sent from Boston.

## TEMPERATURE OF THE AIR.

[*Expressed in degrees, Fahrenheit.*]

The distribution of mean temperature over the United States and Canada for October, 1886, is exhibited on chart ii by the dotted isothermal lines; and in the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service. On chart iv the departures from the normal temperature are illustrated by lines connecting stations of normal or equal abnormal values.

In the following table are given the mean temperatures for the several geographical districts, with the normals and departures, as deduced from Signal Service observations:

*Average temperatures for October.*

| Districts. | Average for October, Signal-Service observations. | | Comparison of Oct., 1886, with the average for several years. |
|---|---|---|---|
| | For several years. | For 1886. | |
| | ° | ° | ° |
| New England | 52.6 | 52.1 | − 0.5 |
| Middle Atlantic States | 57.8 | 58.1 | + 0.3 |
| South Atlantic States | 65.8 | 64.4 | − 1.4 |
| Florida Peninsula | 74.1 | 72.8 | − 1.3 |
| Eastern Gulf States | 66.7 | 65.6 | − 1.1 |
| Western Gulf States | 67.4 | 65.9 | − 1.5 |
| Rio Grande Valley | 74.6 | 73.5 | − 1.1 |
| Tennessee | 60.8 | 59.5 | − 1.3 |
| Ohio Valley | 56.8 | 56.5 | − 0.3 |
| Lower Lake region | 52.2 | 52.6 | + 0.4 |
| Upper Lake region | 47.6 | 50.9 | + 3.3 |
| Extreme Northwest | 42.4 | 46.6 | + 4.2 |
| Upper Mississippi Valley | 53.7 | 57.1 | + 3.4 |
| Missouri Valley | 50.8 | 56.0 | + 5.2 |
| Northern slope | 44.2 | 47.1 | + 2.9 |
| Middle slope | 51.6 | 55.2 | + 3.6 |
| Southern slope | 61.5 | 63.0 | + 1.5 |
| Southern plateau | 59.1 | 58.2 | − 0.9 |
| Middle plateau | 49.7 | 48.0 | − 1.7 |
| North Pacific coast region | 51.1 | 50.2 | − 0.9 |
| Middle Pacific coast region | 61.0 | 58.3 | − 2.7 |
| South Pacific coast region | 66.0 | 62.1 | − 3.9 |

The mean temperature of the month is decidedly above the normal in the upper lake region, upper Mississippi valley, Missouri Valley, extreme northwest, and in eastern Montana; within these districts the departures are large, averaging 4°.5 and ranging from 6°.4, at Yankton, Dakota, to 2°.9, at Alpena, Michigan. In the south Atlantic and Gulf states the month is slightly cooler than the average October, the departures range from 0°.6, at Charleston, South Carolina, to 2°.9, at Chattanooga, Tennessee, and average 1°.3 below the normal.

On the Pacific slope, also, the temperature of the month is below the normal, slightly in the northern portion, and considerably in California. In New England, the Ohio Valley, and the Rocky Mountain region, the temperature is normal, or nearly so.

The following are some of the most marked departures from the normal temperature at Signal Service stations:

| Above normal. | ° | Below normal. | ° |
|---|---|---|---|
| Yankton, Dakota | 6.4 | Yuma, Arizona | 4.9 |
| Moorhead, Minnesota | 6.2 | Sacramento, California | 3.7 |
| Saint Vincent, Minnesota | 6.0 | Los Angeles, California | 3.5 |
| Saint Paul, Minnesota | 6.0 | San Diego, California | 3.1 |
| Omaha, Nebraska | 5.7 | Chattanooga, Tennessee | 2.9 |
| La Crosse, Wisconsin | 4.7 | Cedar Keys, Florida | 2.8 |
| Marquette, Michigan | 4.7 | Little Rock, Arkansas | 2.7 |
| North Platte, Nebraska | 4.7 | Palestine, Texas | 2.5 |
| Huron, Dakota | 4.6 | Red Bluff, California | 2.2 |

*Table of comparative maximum and minimum temperatures for October.*

| State or Territory. | Station. | For 1886. | | Since establishment of station. | | | |
|---|---|---|---|---|---|---|---|
| | | Max. | Min. | Max. | Year. | Min. | Year. |
| | | ° | ° | ° | | ° | |
| Alabama | Mobile | 88.8 | 37.1 | 93.4 | 1884 | 34.0 | 1873 |
| Do | Montgomery | 88.1 | 37.1 | 96.1 | 1884 | 33.0 | 1873 |
| Arizona | Prescott | 77.2 | 26.1 | 86.0 | 1877, 1881 | 18.0 | 1880 |
| Do | Fort Apache | 79.7 | 27.8 | 86.9 | 1885 | 19.0 | 1880 |
| Arkansas | Fort Smith | 82.9 | 31.0 | 94.7 | 1883 | 18.0 | 1873 |
| Do | Little Rock | 82.3 | 33.1 | 91.0 | 1881 | 38.8 | 1885 |
| California | San Francisco | 78.9 | 46.0 | 84.0 | 1871 | 45.0 | 1887 |
| Do | San Diego | 75.0 | 46.6 | 92.0 | 1879 | 44.0 | 1879 |
| Colorado | Denver | 77.0 | 22.6 | 86.0 | 1873 | 1.0 | 1873 |
| Do | Pike's Peak | 57.3 | 3.6 | 47.0 | 1879 | —17.0 | 1878 |
| Connecticut | New Haven | 78.4 | 25.1 | 86.0 | 1881 | 24.0 | 1879 |
| Do | New London | 76.0 | 29.9 | 82.7 | 1879 | 27.2 | 1883 |
| Dakota | Fort Buford | 85.0 | 22.3 | 95.0 | 1879 | 9.0 | 1881 |
| Do | Yankton | 82.6 | 19.9 | 89.0 | 1879 | 9.0 | 1878 |
| Delaware | Del. Breakwater | | | 84.0 | 1881 | 34.5 | 1884 |
| Do | Cape Henlopen | 76.6 | 45.6 | | | | |
| District of Columbia | Washington City | 83.2 | 33.3 | 92.3 | 1881 | 26.0 | 1873 |
| Florida | Jacksonville | 87.3 | 44.0 | 92.0 | 1883 | 40.0 | 1873 |
| Do | Key West | 90.7 | 67.9 | 92.0 | 1876 | 65.0 | 1873, 1876 |
| Georgia | Atlanta | 83.9 | 34.2 | 90.8 | 1884 | 33.6 | 1884 |
| Do | Savannah | 83.3 | 41.8 | 92.0 | 1884 | 37.0 | 1873 |
| Idaho | Boisé City | | | 85.0 | 1879, 1880 | 19.0 | 1878 |
| Illinois | Cairo | 82.6 | 32.0 | 88.0 | '72, '81, '84 | 24.0 | 1873 |
| Do | Chicago | 79.4 | 32.1 | 84.0 | 1879 | 25.0 | 1873 |
| Indiana | Indianapolis | 82.3 | 31.7 | 87.0 | 1884 | 23.0 | 1873 |
| Indian Territory | Fort Sill | 83.0 | 35.2 | 91.0 | 1878 | 25.0 | 1878 |
| Iowa | Dubuque | 85.2 | 26.5 | 86.0 | 1879 | 20.0 | 1873 |
| Do | Keokuk | 81.1 | 33.3 | 87.0 | 1879 | 20.0 | 1873 |
| Kansas | Dodge City | 86.4 | 28.3 | 90.0 | 1883 | 10.0 | 1878 |
| Do | Leavenworth | 86.0 | 26.8 | 89.0 | 1871, 1874 | 19.0 | 1873 |
| Kentucky | Louisville | 83.4 | 30.3 | 90.0 | 1884 | 27.0 | 1878 |
| Louisiana | New Orleans | 87.4 | 45.3 | 90.8 | 1884 | 40.0 | 1873 |
| Do | Shreveport | 84.4 | 39.4 | 95.0 | 1883 | 31.0 | 1873 |
| Maine | Eastport | | | 80.0 | 1879 | 24.0 | 1881 |
| Do | Portland | 78.5 | 27.6 | 83.0 | 1879, 1881 | 28.0 | 1876, 1879 |
| Maryland | Baltimore | 82.3 | 36.4 | 89.0 | 1879, 1881 | 30.0 | '73, '76, '79 |
| Massachusetts | Boston | 79.7 | 27.2 | 90.0 | 1881 | 25.0 | 1879 |
| Michigan | Detroit | 77.0 | 35.7 | 85.0 | 1879, 1884 | 22.0 | 1873 |
| Do | Alpena | 78.3 | 29.0 | 84.0 | 1884 | 20.1 | 1885 |
| Minnesota | Duluth | 80.2 | 27.2 | 78.0 | 1879 | 8.0 | 1878 |
| Do | Saint Paul | 82.0 | 20.9 | 87.0 | 1879 | 15.0 | 1878 |
| Mississippi | Vicksburg | 85.0 | 36.3 | 93.7 | 1884 | 34.0 | 1873 |
| Missouri | Saint Louis | 82.7 | 35.0 | 90.0 | 1879 | 25.0 | 1873 |
| Montana | Fort Benton | | | 87.0 | 1875 | — 6.0 | 1881 |
| Do | Helena | 73.5 | 23.5 | 76.9 | 1885 | 10.0 | 1882 |
| Nebraska | North Platte | 77.3 | 25.6 | 89.0 | 1879 | 11.0 | 1878 |
| Do | Omaha | 85.2 | 15.9 | 87.0 | 1879 | 15.0 | 1878 |
| Nevada | Winnemucca | 76.7 | 16.7 | 84.0 | 1879 | 10.0 | 1875 |
| New Hampshire | Mount Washington | 48.8 | — 0.8 | 59.0 | 1871 | — 3.0 | 1881 |
| New Jersey | Atlantic City | 73.9 | 36.2 | 83.0 | 1881, 1884 | 29.0 | 1879 |
| Do | Sandy Hook | 79.0 | 38.0 | 84.0 | 1879 | 33.0 | 1876 |
| New Mexico | Santa Fé | 69.0 | 30.0 | 85.0 | 1878 | 16.0 | 1880 |
| New York | Buffalo | 71.2 | 33.9 | 83.6 | 1879 | 24.7 | 1884 |
| Do | New York City | 82.5 | 34.6 | 84.5 | 1884 | 31.0 | 1876 |
| North Carolina | Charlotte | 84.5 | 36.6 | 91.9 | 1884 | 30.0 | 1879 |
| Do | Wilmington | 87.1 | 38.4 | 92.5 | 1884 | 32.0 | 1876 |
| Ohio | Cincinnati | 83.4 | 32.5 | 87.7 | 1884 | 27.0 | 1873 |
| Do | Cleveland | 80.0 | 35.1 | 87.0 | 1879 | 26.0 | 1879 |
| Oregon | Portland | 76.0 | 33.9 | 82.2 | 1885 | 31.0 | 1877 |
| Do | Roseburg | 82.0 | 32.7 | 90.9 | 1885 | 22.5 | 1881 |
| Pennsylvania | Pittsburg | 79.2 | 35.5 | 91.1 | 1884 | 28.0 | '73, '76, '78 |
| Do | Philadelphia | 83.7 | 36.8 | 87.0 | 1879, 1881 | 31.0 | 1873, 1876 |
| Rhode Island | Block Island | 71.0 | 35.1 | 75.4 | 1881 | 35.0 | 18-0 |
| South Carolina | Charleston | 86.1 | 44.9 | 93.0 | 18-3 | 39.0 | 1873 |
| Tennessee | Knoxville | 83.0 | 32.0 | 94.0 | 1884 | 25.0 | 1876 |
| Do | Nashville | 84.1 | 33.2 | 91.9 | 1884 | 28.0 | 1873 |
| Texas | Fort Davis | 83.2 | 43.0 | 90.0 | 18-1 | 30.0 | 18-0 |
| Do | Galvestou | 83.4 | 50.2 | 87.2 | 1884 | 45.0 | 1873 |
| Utah | Salt Lake City | 77.3 | 28.6 | 83.0 | 1876 | 22.0 | 1878 |
| Virginia | Lynchburg | 85.5 | 33.7 | 91.3 | 1884 | 28.0 | 1879 |
| Do | Norfolk | 80.6 | 44.3 | 89.0 | 1881, 1884 | 31.0 | 1876 |
| Washington Ter. | Spokane Falls | | | 75.5 | 1885 | 18.0 | 1881 |
| Do | Olympia | 66.2 | 34.0 | 73.0 | 1880 | 23.0 | 1881 |
| Wisconsin | La Crosse | 81.0 | 26.6 | 84.0 | 1879, 1884 | 18.0 | 1873 |
| Do | Milwaukee | 83.3 | 31.3 | 83.1 | 1884 | 22.0 | 1878 |
| Wyoming | Cheyenne | | | 80.0 | '73, '74, '79 | — 4.0 | 1878 |

## DEVIATIONS FROM NORMAL TEMPERATURES.

In the table below are given, for certain stations, as reported by voluntary observers, the normal temperatures for October for a series of years, the mean temperature for October, 1886, and the departures from the normal:

| Station. | County. | Normal temperature for October. | Number of years. | Mean temperature for Oct., 1886. | Departure. |
|---|---|---|---|---|---|
| *Arkansas.* | | ° | | ° | ° |
| Lead Hill | Boone | 61.9 | 5 | 58.3 | — 3.6 |
| *California.* | | | | | |
| Sacramento | Sacramento | 60.6 | 20 | 54.8 | — 5.8 |
| *Connecticut.* | | | | | |
| Middletown * | Middlesex | 50.5 | 28 | 50.4 | — 0.1 |
| New Haven * | New Haven | 51.4 | 100 | 52.8 | + 1.4 |
| Thompson * | Windham | 50.1 | 30 | 50.8 | + 0.7 |
| *Dakota.* | | | | | |
| Webster | Day | 49.8 | 4 | 51.1 | + 1.3 |
| *Florida.* | | | | | |
| Archer | Alachua | 73.0 | 4 | 72.7 | — 0.3 |
| *Illinois.* | | | | | |
| Anna | Union | 60.2 | 11 | 61.1 | + 0.9 |
| Collinsville | Madison | 55.6 | 6 | 58.1 | + 2.5 |
| Mattoon | Coles | 55.0 | 6 | 60.0 | + 5.0 |
| Peoria | Peoria | 54.0 | 30 | 58.4 | + 4.4 |
| Riley | McHenry | 47.7 | 26 | 52.2 | + 4.5 |
| Sandwick | De Kalb | 51.2 | 35 | 54.5 | + 3.3 |
| Sycamore | De Kalb | 50.9 | 6 | 50.6 | — 0.3 |
| *Indiana.* | | | | | |
| Lafayette | Tippecanoe | 53.1 | 7 | 53.5 | + 0.4 |
| Logansport | Cass | 53.2 | 31 | 56.2 | + 3.0 |
| Vevay | Switzerland | 56.2 | 21 | 56.6 | + 0.4 |
| *Iowa.* | | | | | |
| Cresco | Howard | 46.6 | 10 | 51.8 | + 5.2 |
| Monticello | Jones | 49.8 | 33 | 53.0 | + 3.2 |
| *Kansas.* | | | | | |
| Independence | Montgomery | 58.8 | 15 | 59.8 | + 1.0 |
| Wellington | Sumner | 56.5 | 8 | 56.8 | + 0.3 |
| *Maine.* | | | | | |
| Belfast * | Waldo | 47.1 | 27 | 47.7 | + 0.6 |
| Bridgeton * | Cumberland | 47.6 | 12 | 47.8 | + 0.2 |
| Cornish | York | 46.7 | 29 | 46.7 | 0.0 |
| Orono * | Penobscot | 46.2 | 18 | 45.5 | — 0.7 |
| *Maryland.* | | | | | |
| Fallston | Harford | 55.4 | 16 | 56.2 | + 0.8 |
| *Massachusetts.* | | | | | |
| Amherst * | Hampshire | 48.8 | 52 | 49.7 | + 0.9 |
| Cambridge * | Middlesex | 50.4 | 64 | 50.2 | — 0.2 |
| Fitchburg * | Worcester | 48.4 | 30 | 48.3 | — 0.1 |
| Lowell * | Middlesex | 50.7 | 15 | 50.6 | — 0.1 |
| New Bedford * | Bristol | 52.1 | 75 | 51.8 | — 0.3 |
| Somerset | Bristol | 53.3 | 16 | 52.9 | — 0.4 |
| Springfield * | Hampden | 51.2 | 19 | 52.0 | + 0.8 |
| Taunton * | Bristol | 53.9 | 16 | 51.1 | — 2.8 |
| Williamstown * | Berkshire | 46.8 | 31 | 49.3 | + 2.5 |
| *Nevada.* | | | | | |
| Carson City | Ormsby | 47.5 | 7 | 46.2 | — 1.3 |
| *New Brunswick.* | | | | | |
| Saint John * | Saint John | 45.9 | 26 | 45.6 | — 0.3 |
| *New Hampshire.* | | | | | |
| Concord * | Merrimac | 50.7 | 19 | 49.8 | — 0.9 |
| Hanover * | Grafton | 46.1 | 28 | 46.4 | + 0.3 |
| *New Jersey.* | | | | | |
| South Orange | Essex | 53.6 | 17 | 54.3 | + 0.7 |
| *New York.* | | | | | |
| North Volney | Oswego | 49.0 | 19 | 49.8 | + 0.8 |
| Palermo | Oswego | 45.7 | 33 | 47.4 | + 1.7 |
| *Ohio.* | | | | | |
| Wauseon | Fulton | 51.2 | 16 | 52.0 | + 0.8 |
| Westerville | Franklin | 51.7 | 12 | 51.4 | — 0.3 |
| *Pennsylcania.* | | | | | |
| Dyberry | Wayne | 47.0 | 19 | 49.0 | + 2.0 |
| *South Carolina.* | | | | | |
| Stateburg | Sumter | 65.3 | 6 | 63.0 | — 2.3 |
| *Texas.* | | | | | |
| New Ulm | Austin | 69.9 | 15 | 69.1 | — 0.8 |
| *Vermont.* | | | | | |
| Lunenburg * | Essex | 44.7 | 38 | 49.2 | + 4.5 |
| Newport * | Orleans | 46.3 | 11 | 46.3 | 0.0 |
| Strafford | Orange | 47.5 | 12 | 49.0 | + 1.5 |
| *Virginia.* | | | | | |
| Bird's Nest | Northampton | 61.8 | 18 | 53.9 | — 7.9 |
| Dale Enterprise | Rockingham | 59.0 | 6 | 61.3 | + 2.3 |
| Variety Mills | Nelson | 57.6 | 9 | 52.8 | — 4.8 |
| Wytheville | Wythe | 53.7 | 22 | 52.9 | — 0.8 |
| *West Virginia.* | | | | | |
| Helvetia | Randolph | 52.2 | 10 | 49.6 | — 2.6 |

* From the "Bulletin of the New England Meteorological Society."

The following notes, in connection with this subject, are furnished by voluntary observers:

*Illinois.*—Mattoon, Coles county: the highest October temperature during the past six years, 93°.0, occurred in 1883; the lowest, 26°.0, in 1880.

Riley, McHenry county: during the past twenty-six years the warmest October occurred in 1879, mean temperature, 56°.3; the coldest, in 1869, mean temperature, 38°.2.

Sycamore, De Kalb county: during the past six years the warmest October occurred in 1882, mean temperature, 55°.6; the coldest in 1885, mean temperature, 44°.8.

*Indiana.*—Logansport, Cass county: temperature comparisons for October

during the past thirty-one years: highest monthly mean, 59°.2, in 1884; lowest monthly mean, 42°.5, in 1869; highest maximum, 92°.0, in 1879; lowest minimum, 12°.0, in 1869.

Vevay, Switzerland county: the highest October temperature during the past twenty-one years, 96°.0, occurred in 1865; the lowest, 21°.0, in 1869.

*Iowa.*—Monticello, Jones county: during the past thirty-three years the warmest October occurred in 1879, mean temperature, 58°.0; the maximum temperature in that time, 88°.0, occurred in 1882; the minimum, 15°.0, in 1859.

*Maine.*—Cornish, York county: during the past twenty-nine years the warmest October occurred in 1879, mean temperature, 52°.6; the coldest in 1864, mean, 40°.9.

*Maryland.*—Fallston, Harford county: in the past sixteen years the highest October mean temperature, 62°.2, occurred in 1879; the lowest mean, 48°.5, in 1876.

*New York.*—North Volney, Oswego county: in the past nineteen years the highest October mean temperature, 55°.5, occurred in 1879; the lowest during the same time, 44°.7 occurred in 1876.

Palermo, Oswego county: in the past thirty-three years the highest October mean temperature, 53°.9, occurred in 1879; the lowest mean, 39°.3, in 1873.

*Ohio.*—Westerville, Franklin county: temperature comparisons for October during the past twelve years: highest mean temperature, 57°.7, in 1880; lowest mean, 46°.1, in 1876; highest temperature, 85°.5, in 1884; lowest temperature, 17°.5, in 1879.

Wauseon, Fulton county: the highest October mean temperature during the past sixteen years, 59°.0, occurred in 1879; the lowest mean, 46°.0, in 1875; the highest temperature, 87°.7, occurred in 1884; the lowest, 12°.0, in 1874.

*Texas.*—New Ulm, Austin county: during the past fifteen years the warmest October occurred in 1881, mean temperature, 73°.9; the coldest in 1873, mean, 65°.8; the highest October temperature during that time, 99°.0, occurred in 1877; the lowest, 36°.0, in 1873.

*Vermont.*—Strafford, Orange county: the highest October mean temperature during the past twelve years, 52°.8, occurred in 1879; the lowest, 43°.7, in 1875.

*Virginia.*—Dale Enterprise, Rockingham county: during the past six years the warmest October occurred in 1883, mean temperature, 64°.7; the coldest in 1880, mean, 52°.6.

Variety Mills, Nelson county: during the past nine years the highest October mean temperature, 61°.9, occurred in 1881; the lowest mean, 52°.0, in 1885.

## RANGES OF TEMPERATURE.

The monthly, and the greatest and least daily, ranges of temperature, are given in the table of miscellaneous meteorological data.

The following are some of the greatest and least monthly ranges at Signal Service stations:

| Greatest. | ° | Least. | ° |
|---|---|---|---|
| Moorhead, Minnesota | 72.8 | Tatoosh Island, Washington Ter | 19.8 |
| Poplar River, Montana | 70.7 | Fort Canby, Washington Ter | 22.2 |
| Omaha, Nebraska | 69.3 | Key West, Florida | 22.8 |
| Fort Yates, Dakota | 68.4 | Astoria, Oregon | 27.0 |
| Saint Vincent, Minnesota | 66.7 | San Diego, California | 28.4 |
| Huron, Dakota | 65.2 | Port Angeles, Washington Ter | 29.4 |
| Fort Klamath, Oregon | 63.0 | Sanford, Florida | 29.8 |
| Yankton, Dakota | 62.7 | Hatteras, North Carolina | 30.6 |
| Fort Buford, Dakota | 62.7 | Cape Henry, Virginia | 31.7 |

## FROSTS.

The killing frosts that occurred on the mornings of the 2d and 3d were especially disastrous to the tobacco crop in Maryland, Virginia, North Carolina, Tennessee, and Kentucky, the loss in these states is placed at one fifth of the value of the crop.

The following reports from observers relate to these frosts:

Lynchburg, Virginia: the first frost of the season occurred on the morning of the 2d; in the immediate vicinity of this station it was light and did little damage, but in other portions of the surrounding country the damage done to the tobacco crop was great. Reports from Danville state that one-third of the lowland tobacco crop was injured.

Asheville, Buncombe county, North Carolina: the first frost of the season occurred on the morning of the 2d. It was heavy and injured vegetation, particularly the tobacco crop, to a considerable extent.

Reidsville, Rockingham county, North Carolina: the uncut tobacco, about one-half of the crop, was damaged on the mornings of the 2d and 3d by heavy frosts.

Louisville, Kentucky: on the morning of the 2d killing frosts occurred in the lowlands in every part of the state, about half of the tobacco crop which still remained in the fields uncut was much impaired in quality from the effects of the frost.

Nashville, Tennessee: reports from the principal tobacco-growing counties of the state say that the frost of the morning of the 2d reduced the quality of the outstanding crop from thirty to thirty-five per cent.

Altamahaw, Alamance county, North Carolina: the first frost of the season occurred on the morning of the 3d, doing considerable damage to the tobacco crop.

Frosts also formed in the various states and territories during the month, as follows:

*Alabama.*—Montgomery and Mobile, 28th, 29th; Livingston and Greensborough, 28th to 31st.

*Arizona.*—3d, 4th, 8th, 12th, 13th, 14th, 19th to 25th, 28th, 29th, 30th.

*Arkansas.*—Fort Smith, 27th, 28th, 29th; Lead Hill, 27th, 28th, 30th; Little Rock, 27th to 30th.

*California.*—Princeton, 3d, 4th; Fort Bidwell, 6th, 12th, 20th, 31st; Nicolaus, 9th, 10th; Sacramento, 9th to 13th, 16th, 19th to 22d, 26th; Hydesville, 10th, 11th, 12th, 31st; Keeler, 11th; Los Angeles, 11th, 12th, 20th, 22d to 25th; Poway, 13th.

*Colorado.*—6th, 7th, 8th, 10th, 12th to 15th, 17th, 18th, 20th to 31st.

*Connecticut.*—1st to 5th, 7th, 17th, 22d, 23d, 24th.

*Dakota.*—1st, 2d, 12th, 15th, 16th, 17th, 20th, 21st, 24th to 30th.

*District of Columbia.*—2d, 3d, 17th, 22d.

*Florida.*—Pensacola and Tallahassee, 28th, 29th; Jacksonville and Archer, 29th, 30th, 31st.

*Georgia.*—Savannah, 28th, 30th, 31st; Atlanta, 28th, 29th, 30th; Augusta, Milledgeville, and Forsyth, 28th to 31st; Quitman, 29th, 30th, 31st.

*Idaho.*—6th, 9th, 13th, 17th to 22d, 24th, 25th, 26th, 31st.

*Illinois.*—1st, 2d, 3d, 13th, 15th, 16th, 21st, 22d, 27th to 31st.

*Indiana.*—1st to 4th, 16th, 17th, 22d, 23d, 30th, 31st.

*Indian Territory.*—Fort Reno, 24th to 28th; Fort Sill, 27th; Fort Supply, 26th, 27th.

*Iowa.*—1st, 2d, 4th, 15th, 16th, 21st, 22d, 25th to 30th.

*Kansas.*—1st, 2d, 15th, 21st, 23d, 25th to 29th.

*Kentucky.*—Bowling Green, 1st; Frankfort, 2d, 3d, 4th, 16th, 22d, 23d, 30th; Richmond, 2d, 3d, 16th, 30th; Louisville, 2d, 30th, 31st.

*Louisiana.*—Liberty Hill, 2d, 17th, 28th.

*Maine.*—3d, 4th, 17th, 19th, 20th, 22d, 23d, 24th, 27th.

*Maryland.*—2d, 3d, 17th.

*Massachusetts.*—1st to 7th, 16th to 20th, 22d, 24th, 25th.

*Michigan.*—1st to 6th, 15th to 18th, 21st, 23d, 25th to 31st.

*Minnesota.*—1st, 2d, 12th, 15th to 18th, 21st, 24th to 30th.

*Mississippi.*—Vicksburg, 3d, 28th, 29th, 30th.

*Missouri.*—1st, 2d, 5th, 21st, 27th to 30th.

*Montana.*—1st, 2d, 3d, 10th, 11th, 12th, 14th to 17th, 19th, 22d, 24th to 28th, 30th, 31st.

*Nebraska.*—1st, 2d, 13th to 21st, 23d to 31st.

*Nevada.*—1st to 6th, 9th to 28th, 30th, 31st.

*New Hampshire.*—2d to 6th, 8th, 17th, 19th to 22d, 24th, 25th.

*New Jersey.*—2d, 3d, 4th, 17th, 22d, 24th.

*New Mexico.*—Fort Stanton, 1st, 2d, 14th, 15th, 24th, 28th, 29th, 30th; Gallinas Spring, 1st, 4th, 29th; Santa Fé, 13th, 22d, 25th, 27th; Lava, 15th, 30th.

*New York.*—2d, 3d, 4th, 7th, 16th to 19th, 22d, 23d, 24th.

*North Carolina.*—Reidsville, 1st to 5th, 8th, 11th, 16th, 21st, 22d, 24th, 29th, 31st; Statesville, 2d, 3d, 4th; Lenoir, 2d, 11th; Flat Rock, 3d, 4th; Weldon and Raleigh, 3d, 29th; Charlotte, 28th to 31st; Chapel Hill, 29th, 30th; Wash Woods, 30th, 31st.

*Ohio.*—1st to 4th, 15th, 16th, 17th, 19th, 22d, 23d, 28th to 31st.

*Oregon.*—2d to 7th, 10th to 13th, 17th to 31st.

*Pennsylvania.*—1st to 8th, 16th, 17th, 19th, 22d to 25th, 29th, 31st.

*Rhode Island.*—2d.

*South Carolina.*—Spartanburg, 3d, 4th, 27th, 28th, 30th, 31st; Pacolet, 3d, 28th to 29th, 30th; Stateburg, 28th, 29th, 30th.

*Tennessee.*—Milan, 2d, 3d, 4th, 16th, 28th to 30th; Memphis, 2d, 3d, 27th to 31st; Nashville, 2d, 16th, 22d, 28th, 30th, 31st; Chattanooga, 28th to 31st; Knoxville, 30th, 31st.

*Texas.*—Cleburne, 1st, 27th; Silver Falls, 16th; Fort Elliott, 26th, 27th; Corsicana, 27th; Palestine, 27th, 28th, 29th.

*Utah.*—11th, 12th, 13th, 19th, 20th, 23d, 24th, 25th.

*Vermont.*—2d to 9th, 16th, 17th, 19th, 20th, 22d, 24th.

*Virginia.*—1st to 6th, 17th, 22d, 23d, 27th, 29th, 30th.

*Washington Territory.*—9th to 12th, 20th to 26th, 29th, 31st.

*West Virginia.*—1st to 5th, 16th, 17th, 19th, 22d, 23d, 30th, 31st.†

*Wisconsin.*—1st to 5th, 15th to 21st, 26th to 31st.

*Wyoming.*—26th.

### ICE.

The formation of ice in the southern parts of the country occurred on the following dates:

*Arkansas.*—Lead Hill, 28th, 31st.

*California.*—Salinas, 31st.

*Kansas.*—Manhattan, 1st, 27th; Salina, 25th.

*Maryland.*—Fallston, 17th.

*Missouri.*—Oregon, 1st.

*North Carolina.*—Reidsville, 2d.

*Texas.*—Silver Falls, 1st.

### TEMPERATURE OF WATER.

The following table shows the highest and lowest temperatures of water observed at the several stations; the monthly ranges of water temperature; the average depth at which the observations were made; and the mean temperature of the air:

*Temperature of water for October, 1886.*

| Station. | Temperature at bottom. | | Range. | Average depth, feet and tenths. | Mean temperature of the air at station. |
|---|---|---|---|---|---|
| | Max. | Min. | | | |
| | ° | ° | ° | | ° |
| Alpena, Michigan | 57.1 | 45.3 | 11.8 | 11.7 | 48.1 |
| Augusta, Georgia | 77.0 | 59.5 | 17.5 | 5.7 | 61.7 |
| Baltimore, Maryland | 71.5 | 59.6 | 11.9 | 11.5 | 58.6 |
| Block Island, Rhode Island | 62.7 | 55.0 | 7.7 | 8.9 | 54.8 |
| Boston, Massachusetts | 56.1 | 49.2 | 6.9 | 23.5 | 51.5 |
| Buffalo, New York | 61.9 | 52.5 | 9.4 | 13.9 | 52.0 |
| Canby Fort, Washington Territory | 57.9 | 50.6 | 7.3 | 14.2 | 52.4 |
| Cedar Keys, Florida | 80.8 | 67.7 | 13.1 | 7.6 | 71.2 |
| Charleston, South Carolina | 79.4 | 64.9 | 14.5 | 37.6 | 66.5 |
| Chicago, Illinois | 60.4 | 47.3 | 13.1 | 8.4 | 56.6 |
| Chincoteague, Virginia | 73.6 | 58.0 | 15.6 | 3.9 | 61.0 |
| Cleveland, Ohio | 66.8 | 52.8 | 14.0 | 13.5 | 53.9 |
| Detroit, Michigan | 61.5 | 48.7 | 12.8 | 27.7 | 54.8 |
| Duluth, Minnesota | 48.7 | 42.1 | 6.6 | 10.5 | 46.9 |
| Escanaba, Michigan | 53.6 | 49.0 | 4.6 | 18.9 | 48.2 |
| Galveston, Texas | 77.3 | 65.6 | 11.7 | 15.2 | 71.6 |
| Grand Haven, Michigan | 63.0 | 48.7 | 14.3 | 18.4 | 52.3 |
| Jacksonville, Florida | 83.7 | 68.0 | 15.7 | 18.0 | 68.9 |
| Key West, Florida | 84.7 | 74.7 | 10.0 | 18.7 | 78.3 |
| Mackinaw City, Michigan | 56.8 | 49.0 | 7.8 | 10.0 | 50.3 |
| Macon, Fort, North Carolina | 78.3 | 65.6 | 12.7 | 14.2 | 64.8 |
| Marquette, Michigan | 57.7 | 47.1 | 10.0 | 12.0 | 50.3 |
| Mobile, Alabama | 80.0 | 69.0 | 11.0 | 17.1 | 64.7 |
| New London, Connecticut | 64.6 | 56.3 | 8.3 | 12.8 | 53.4 |
| New York City | 68.8 | 57.2 | 11.6 | 15.1 | 56.5 |
| Norfolk, Virginia | 73.7 | 60.3 | 13.4 | 16.6 | 61.3 |
| Pensacola, Florida | 76.3 | 66.2 | 10.1 | 17.9 | 69.0 |
| Portland, Maine | 55.9 | 47.5 | 8.4 | 17.5 | 47.9 |
| Portland, Oregon | 60.8 | 47.9 | 12.9 | 48.8 | 51.4 |
| Sandusky, Ohio | 63.0 | 49.1 | 13.9 | 10.3 | 54.0 |
| Sandy Hook, New Jersey* | 68.2 | 58.0 | 10.2 | 13.3 | 57.4 |
| San Francisco, California | 58.3 | 55.9 | 2.4 | 38.8 | 57.1 |
| Savannah, Georgia | 78.7 | 63.1 | 15.6 | 11.0 | 66.2 |
| Smithville, North Carolina | 79.2 | 65.0 | 14.2 | 10.4 | 63.5 |
| Toledo, Ohio | 65.2 | 48.7 | 16.5 | 12.9 | 53.4 |
| Wilmington, North Carolina† | | | | | |

* Record for first 21 days of month. † Observations temporarily suspended.

### PRECIPITATION.

[*Expressed in inches and hundredths.*]

The distribution of rainfall over the United States and Canada for October, 1886, as determined from the reports of about seven hundred stations, is exhibited on chart iii.

Owing to the unusually small amount of precipitation during the month, a shading to represent from one to two inches is used; usually, areas of less than two inches of precipitation are not shaded.

The precipitation of the month is largely below the normal in nearly every district of the United States, the only exceptions being the northern and middle portions of the Rocky Mountain region, the middle Pacific coast, northern Texas, and the western portion of the Indian Territory; in these districts the rainfall of the month is considerably above the normal. In Arizona and along the southern Pacific coast it is about normal, or only slightly above. Although the whole of the Mississippi Valley and all the country lying to the eastward is largely below the normal the greatest departures occur in the south Atlantic states, Gulf States, and Ohio Valley; within this large area one station only, Sanford, Florida, reports an excess of rainfall. The normal rainfall of the south Atlantic states for October, as deduced from the Signal Service observations of the past thirteen years, is 4.30, while the average for these states during October, 1886, is only .69, less than one-sixth of the normal; in the eastern Gulf states the deficiency is even greater; the normal for these states is 3.30, while the average of the Signal Service records of the present month within this area is only .36, about one-ninth of the normal quantity. The only stations east of the one-hundredth meridian at which an excess of rain fell are, Dubuque, Iowa, excess .95; Mackinaw City, Michigan, .22; Portland, Maine, 3.09; New York City, .58; Sandy Hook, New Jersey, 3.30; Atlantic City, New Jersey, 5.34; Sanford, Florida, 2.46.

The following are some of the most marked departures from the normal precipitation at Signal Service stations:

| Above normal. | | Below normal. | |
|---|---|---|---|
| | *Inches.* | | *Inches.* |
| Atlantic City, New Jersey | 5.34 | Hatteras, North Carolina | 6.01 |
| Fort Sill, Indian Territory | 4.73 | Charleston, South Carolina | 4.89 |
| Sandy Hook, New Jersey | 3.30 | Brownsville, Texas | 4.50 |
| Portland, Maine | 3.09 | Smithville, North Carolina | 4.39 |
| Sanford, Florida | 2.46 | Springfield, Illinois | 3.80 |
| Winnemucca, Nevada | 1.17 | Pensacola, Florida | 3.76 |
| Yuma, Arizona | 1.07 | Jacksonville, Florida | 3.76 |
| Dubuque, Iowa | 0.95 | Wilmington, North Carolina | 3.61 |
| Fort Thomas, Arizona | 0.82 | Galveston, Texas | 3.58 |
| Fort Custer, Montana | 0.75 | Mobile, Alabama | 3.53 |

In the following table are shown, for the several geographical districts, the normal precipitation for October; the average for October, 1886, and the excess or deficiency as compared with the normal:

*Average precipitation for October.*

| Districts. | Average for Oct., Signal-Service observations. | | Comparison of Oct., 1886, with the average for several years. |
|---|---|---|---|
| | For several years. | For 1886. | |
| | *Inches.* | *Inches.* | *Inches.* |
| New England | 4.23 | 3.88 | — 0.35 |
| Middle Atlantic States | 3.25 | 2.78 | — 0.47 |
| South Atlantic States | 4.30 | 0.69 | — 3.61 |
| Florida Peninsula | 5.42 | 4.27 | — 1.15 |
| Eastern Gulf States | 3.30 | 0.36 | — 2.94 |
| Western Gulf States | 3.73 | 1.44 | — 2.29 |
| Rio Grande Valley | 3.71 | 0.34 | — 3.37 |
| Tennessee | 3.35 | 0.81 | — 2.54 |
| Ohio Valley | 3.20 | 0.88 | — 2.32 |
| Lower lake region | 3.37 | 1.52 | — 1.85 |
| Upper lake region | 3.56 | 2.23 | — 1.33 |
| Extreme northwest | 1.85 | 1.46 | — 0.39 |
| Upper Mississippi Valley | 3.38 | 1.70 | — 1.68 |
| Missouri Valley | 2.58 | 1.18 | — 1.40 |
| Northern slope | 1.09 | 0.84 | — 0.25 |
| Middle slope | 1.44 | 1.11 | — 0.33 |
| Southern slope | 2.26 | 3.90 | + 1.64 |
| Southern plateau | 0.76 | 0.77 | + 0.01 |
| Middle plateau | 1.13 | 1.85 | + 1.72 |
| North Pacific coast region | 4.19 | 3.48 | — 0.71 |
| Middle Pacific coast region | 1.14 | 1.31 | + 0.17 |
| South Pacific coast region | 0.36 | 0.39 | + 0.03 |

### DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows, for certain stations, as reported by voluntary observers, the average precipitation for the month

of October for a series of years, the precipitation for October, 1886, and the departures from the average:

| Station. | County. | Average precipitation for October. | Number of years. | Precipitation for October, 1886. | Departure. |
|---|---|---|---|---|---|
| | | Inches. | | Inches. | Inches. |
| *Arkansas.* | | | | | |
| Lead Hill | Boone | 6.74 | 5 | 0.10 | − 6.64 |
| *California.* | | | | | |
| Sacramento | Sacramento | 0.77 | 30 | 0.79 | + 0.02 |
| *Connecticut.* | | | | | |
| Canton * | Hartford | 4.99 | 35 | 2.70 | − 2.29 |
| Middletown * | Middlesex | 3.88 | 38 | 3.31 | − 0.57 |
| New Haven * | New Haven | 3.80 | 14 | 1.95 | − 1.85 |
| Wallingford * | New Haven | 4.00 | 38 | 2.73 | − 1.27 |
| *Dakota.* | | | | | |
| Webster | Day | 5.03 | 4 | 1.77 | − 3.26 |
| *Florida.* | | | | | |
| Archer | Alachua | 2.01 | 4 | 2.11 | + 0.10 |
| *Illinois.* | | | | | |
| Anna | Union | 3 99 | 11 | 0.74 | − 3.25 |
| Collinsville | Madison | 3.05 | 6 | 0.78 | − 2.27 |
| Mattoon | Coles | 5.33 | 6 | 1.05 | − 4.28 |
| Peoria | Peoria | 2.71 | 30 | 1.81 | − 0.90 |
| Riley | McHenry | 3.61 | 26 | 2.55 | − 0.06 |
| Sandwich | De Kalb | 3.25 | 35 | 1.65 | − 1.60 |
| Sycamore | De Kalb | 3.95 | 6 | 2.26 | − 1.69 |
| *Indiana.* | | | | | |
| Lafayette | Tippecanoe | 3.00 | 7 | 0.73 | − 2.27 |
| Logansport | Cass | 2.73 | 31 | 1.30 | − 1.43 |
| Spiceland | Henry | 2.27 | 27 | 1.00 | − 1.27 |
| Vevay | Switzerland | 2.65 | 21 | 0.91 | − 1.74 |
| *Iowa.* | | | | | |
| Cresco | Howard | 2.56 | 14 | 1.72 | − 0.84 |
| Monticello | Jones | 3.94 | 33 | 5.34 | + 2.40 |
| *Kansas.* | | | | | |
| Independence | Montgomery | 3.11 | 14 | 1.02 | − 2.09 |
| Wellington | Sumner | 2.83 | 8 | 1.29 | − 1.54 |
| *Maine.* | | | | | |
| Cornish | York | 4.32 | 39 | 5.10 | + 0.78 |
| Orono * | Penobscot | 4.50 | 18 | 1.42 | − 3.08 |
| *Maryland.* | | | | | |
| Fallston | Harford | 3.46 | 16 | 2.24 | − 1.22 |
| *Massachusetts.* | | | | | |
| Amherst * | Hampshire | 3.77 | 32 | 3.06 | − 0.71 |
| Cambridge * | Middlesex | 3.39 | 46 | 2.72 | − 0.67 |
| Chestnut Hill * | Middlesex | 3.77 | 11 | 3.21 | − 0.56 |
| Framingham * | Middlesex | 3.94 | 12 | 3.49 | − 0.45 |
| Lake Cochituate * | Middlesex | 4.17 | 35 | 3.16 | − 1.01 |
| Lowell * | Middlesex | 3.67 | 61 | 2.64 | − 1.03 |
| Mystic Lake * | Middlesex | 3.48 | 11 | 2.98 | − 0.50 |
| New Bedford * | Bristol | 3.81 | 74 | 4.23 | + 0.42 |
| Somerset | Bristol | 3.85 | 16 | 3.82 | − 0.03 |
| Springfield * | Hampden | 4.17 | 39 | 3.46 | − 0.71 |
| Taunton * | Bristol | 3.58 | 12 | 3.02 | − 0.56 |
| Waltham * | Middlesex | 3.67 | 62 | 3.19 | − 0.48 |
| Williamstown * | Berkshire | 2.82 | 19 | 2.60 | − 0.22 |
| *Nevada.* | | | | | |
| Carson City | Ormsby | 0.45 | 8 | 0.21 | − 0.24 |
| *New Brunswick.* | | | | | |
| Saint John * | Saint John | 4.63 | 26 | 4.90 | + 0.27 |
| *New Hampshire.* | | | | | |
| Concord * | Merrimac | 3.87 | 31 | 2.63 | − 1.24 |
| Hanover * | Grafton | 2.27 | 22 | 2.45 | + 0.18 |
| *New Jersey.* | | | | | |
| South Orange | Essex | 3.48 | 17 | 2.40 | − 1.08 |
| *New York.* | | | | | |
| Palermo | Oswego | 3.48 | 33 | 1.85 | − 1.63 |
| *Ohio.* | | | | | |
| Wauseon | Fulton | 3.68 | 14 | 1.94 | − 1.08 |
| Westerville | Franklin | 2.43 | 12 | 1.33 | − 1.10 |
| *Pennsylvania.* | | | | | |
| Dyberry | Wayne | 3.17 | 16 | 2.42 | − 0.75 |
| Grampian Hills | Clearfield | 3.02 | 15 | 0.97 | − 2.05 |
| *South Carolina.* | | | | | |
| Stateburg | Sumter | 2.23 | 6 | 2.02 | − 0.21 |
| *Texas.* | | | | | |
| New Ulm | Austin | 4.13 | 15 | 0.92 | − 3.21 |
| *Vermont.* | | | | | |
| Lunenburg * | Essex | 3.55 | 39 | 1.40 | − 2.15 |
| Newport * | Orleans | 4.11 | 11 | 2.20 | − 1.91 |
| Strafford | Orange | 3.21 | 12 | 2.03 | − 1.18 |
| *Virginia.* | | | | | |
| Bird's Nest | Northampton | 3.26 | 18 | 2.05 | − 1.21 |
| Dale Enterprise | Rockingham | 2.05 | 6 | 2.54 | + 0.49 |
| Variety Mills | Nelson | 3.54 | 8 | 1.07 | − 2.47 |
| Wytheville | Wythe | 2.93 | 22 | 0.87 | − 2.06 |
| *West Virginia.* | | | | | |
| Helvetia | Randolph | 3.45 | 10 | 1.35 | − 2.10 |

* From the "Bulletin of the New England Meteorological Society."

The following notes, in connection with this subject, are furnished by voluntary observers:

*Illinois.*—Sandwich, De Kalb county: the largest October rainfall during the past thirty-five years, 7.65, occurred in 1882; the least, 0.19, in 1877.

Mattoon, Coles county: the greatest October precipitation during the past six years, 11.25, occurred in 1881; the least, 1.06, in 1886.

Riley, McHenry county: the precipitation of October, 1881, 6.81, is the greatest, and that of October, 1872, 0.62, the least, that has fallen in October during the past twenty-six years.

Sycamore, De Kalb county: the greatest October precipitation during the past six years, 8.20, occurred in 1881; the least, 2.26, in 1886.

*Indiana.*—Logansport, Cass county: during the past thirty-one years the greatest monthly precipitation for October, 6.98, occurred in 1877; the least, 1.10, in 1874.

Vevay, Switzerland county: during the past twenty-one years the greatest monthly precipitation for October, 7.67, fell in 1883; the least, 0.28, in 1879.

*Iowa.*—Monticello, Jones county: during the past thirty-three years the greatest monthly precipitation for October, 7.21, occurred in 1881; the least, 0.43, in 1872.

*Kansas.*—Independence, Montgomery county: the total precipitation of the ten months of the current year ending October 31st, 23.20, is 10.36 below the average for the same months during the past fourteen years.

*Maryland.*—Fallston, Hartford county: during the last sixteen Octobers the greatest precipitation, 7.70, occurred in 1878; the least, 0.23, in 1874.

*New York.*—Palermo, Oswego county: during the past thirty-three years the greatest monthly precipitation for October, 7.90, fell in 1862; the least, 0.30, in 1882.

*Ohio.*—Westerville, Franklin county: during the past twelve years the greatest monthly precipitation for October, 4.59, fell in 1881; the least, 0.56, in 1879.

Wauseon, Fulton county: the total precipitation for the ten months of the current year ending October 31st, 24.65, is 7.18 less than the normal for the same months as deduced from the observations of the past fourteen years; the largest October precipitation during that time, 8.92, occurred in 1881; the smallest, 0.93, in 1874.

*Texas.*—New Ulm, Austin county: during the past fifteen years the greatest monthly precipitation for October, 12.44, occurred in 1881; the least, 0.79, in 1874.

*Vermont.*—Strafford, Orange county: during the past twelve years the greatest monthly precipitation for October, 5.90, occurred in 1885; the least, 1.20, in 1882.

*Virginia.*—Dale Enterprise, Rockingham county: during the past six years the greatest monthly precipitation for October, 12.60, fell in 1885; the least, 0.96, in 1884.

Variety Mills, Nelson county: the largest October precipitation during the past eight years, 10.76, fell in 1885; the least, 0.96, in 1884.

Wytheville, Wythe county: the total precipitation of the ten months ending October 31st, 38.43, is 2.40 above the normal of the same months as deduced from the observations of the past twenty-two years.

*Table of excessive and greatest monthly precipitation for October*, 1886.

| Station. | Specially heavy. | | Largest monthly. | Station. | Specially heavy. | | Largest monthly. |
|---|---|---|---|---|---|---|---|
| | Date. | Amt. | Amount. | | Date. | Amt. | Amount. |
| *Arkansas.* | | | | *Michigan—Con.* | | | |
| Texarkana | 13 | 2.34 | ..... | Pentwater | 14 | 2.20 | ..... |
| *Connecticut.* | | | | *Missouri.* | | | |
| New London | 7 | 2.00 | ..... | Oregon | 21, 22 | 4.35 | ..... |
| *Florida.* | | | | *Nebraska.* | | | |
| Sanford | ..... | ..... | 8.75 | Brownville | 22 | 2.87 | ..... |
| Manatee | 9, 10, 11 | 3.61 | ..... | *New Hampshire.* | | | |
| Alva | 9, 10 | 2.75 | ..... | Antrim | 27 | 2.00 | ..... |
| *Illinois.* | | | | *New Jersey.* | | | |
| Rockford | 13, 14 | 3.48 | ..... | Atlantic City | 30 | 6.02 | 8.16 |
| Stephenson | 14 | 2.50 | ..... | Sandy Hook | 27 | 3.88 | 6.70 |
| Knox | 14 | 2.00 | ..... | *New York.* | | | |
| *Indian Territory.* | | | | New York City | 26, 27 | 3.90 | ..... |
| Fort Sill | ..... | ..... | 7.10 | Brooklyn | 26, 27 | 3.48 | ..... |
| Fort Reno | 20, 21 | 2.90 | ..... | Setauket | 27 | 2.36 | ..... |
| *Iowa.* | | | | *Oregon.* | | | |
| Manchester | 13, 14 | 6.70 | 8.15 | Bandon | 14 | 2.65 | ..... |
| Urbana | 12 | 2.65 | ..... | *South Carolina.* | | | |
| Clinton | 13, 14 | 3.50 | ..... | Stateburg | 26, 27 | 2.02 | ..... |
| Monticello | 13, 14 | 2.75 | ..... | *Texas.* | | | |
| Do | 22, 23 | 2.59 | ..... | Sour Lake | 9 | 2.24 | 9.45 |
| Cedar Rapids a | 13, 14 | 3.59 | ..... | Do | 13 | 6.80 | ..... |
| Cedar Rapids b | 13, 14 | 3.13 | ..... | *Washington Ter.* | | | |
| Independence | 14 | 2.00 | ..... | Tatoosh Island | 14, 15 | 2.57 | 7.81 |
| *Maine.* | | | | *Wisconsin.* | | | |
| Portland | 30 | 4.74 | 6.70 | Embarras | 11 | 2.35 | ..... |
| Kent's Hill | 31 | 2.62 | ..... | Do | 13, 14 | 2.50 | ..... |
| Cornish | 31 | 3.41 | ..... | Wausau | 12 | 2.22 | ..... |
| *Massachusetts.* | | | | Prairie du Chien | 13, 14 | 3.12 | ..... |
| North Truro | 27, 28 | 3.04 | ..... | Green Bay | 13, 14 | 2.82 | ..... |
| *Michigan.* | | | | | | | |
| Fort Brady | 14 | 2.22 | ..... | | | | |

## SNOW.

Snow fell in the various states and territories, as follows:

*Arizona.*—Prescott, 11th, 12th.

*California.*—Fort Bidwell, 5th, 9th, 11th, 30th; Susanville, 30th.

*Colorado.*—Pike's Peak, 4th to 9th, 11th, 12th, 16th, 21st, 22d, 28th.

*Dakota.*—Fort Meade, 13th; Fort Buford, 15th; Bismarck, 15th, 19th; Fort Totten, 19th, 20th; Richardton, 19th, 21st; Webster, 21st; Fort Sisseton, Deadwood, and Fort Yates, 24th.

*Illinois.*—Charleston, 28th.

*Indiana.*—Fort Wayne, 27th; Spiceland, 27th, 28th.

*Maine.*—Portland, 16th.

*Massachusetts.*—Princeton, 16th.

*Michigan.*—Lansing, 1st; Alpena, 1st, 5th, 25th; Mackinaw City, 1st, 15th, 16th, 17th; Escanaba, 15th, 16th, 17th; Thornville, 17th; Marquette, 15th, 25th.

*Minnesota.*—Duluth and Saint Vincent, 16th.

*Montana.*—Helena, 9th, 10th, 15th, 23d, 29th; Fort Maginnis, 10th, 14th, 15th, 23d, 24th, 29th; Fort Shaw, 14th, 15th, 16th, 18th, 23d, 24th; Fort Benton, 14th to 17th; Fort Assinaboine, 14th, 25th; Poplar River, 15th; Fort Custer, 19th, 24th.

*Nevada.*—Fort Halleck, 9th, 10th, 11th, 18th, 19th, 20th, 30th, 31st; Winnemucca, 10th, 11th, 31st; Fort McDermit, 10th, 12th, 14th.

*New Hampshire.*—Mount Washington, 1st, 2d, 16th, 17th, 18th, 27th, 31st; Berlin Mills, 2d, 26th.

*New York.*—North Volney, 1st, 2d, 17th; Buffalo, 1st, 15th, 16th; Ithaca, 16th; Le Roy, 16th, 26th; Rochester, Oswego, and Madison Barracks, 17th.

*Ohio.*—Elyria, 1st; Cincinnati, Wauseon, and North Lewisburg, 27th; Columbus, 27th, 28th; Napoleon and Tiffin, 28th.

*Oregon.*—Fort Klamath, 8th, 9th, 15th, 16th; Lakeview, 10th, 18th, 29th; Linkville, 15th, 16th, 29th, 30th.

*Utah.*—Frisco, 10th, 11th, 12th, 18th, 19th, 21st, 22d; Salt Lake City, 10th, 19th.

*Vermont.*—Burlington, 16th; Newport, 16th, 17th; Charlotte, 17th.

*Wyoming.*—Fort Bridger, 11th, 18th, 19th, 22d, 31st.

### MONTHLY SNOWFALLS.

[*Expressed in inches and tenths.*]

The following stations report monthly snowfalls of one inch or more:

*California.*—Summit, 31; Emigrant Gap, 15; Cisco, 14.5; Truckee, 8.5; Boca, 7; Fort Bidwell, 1.

*Colorado.*—Pike's Peak, 7.8.

*Dakota.*—Richardton, 2.2.

*Indiana.*—Farmland, 6.2; Spiceland and Mauzy, 6; Sunman, 4; Richmond, 3.5; Marion, 1.

*Michigan.*—Marquette, 1.

*Montana.*—Fort Shaw, 4.3; Fort Assinaboine, 4; Fort Benton, 2.7; Helena, 1.1.

*Nevada.*—Otego, 12; Toano, 5.8; Wadsworth, 5; Palisade, 4; Carlin, 3.5; Battle Mountain, 2.2; Elko, Winnemucca, and Hot Springs, 2; Carson City, 1.5.

*New Hampshire.*—Mount Washington, 4.4.

*Ohio.*—West Milton, 4.5; North Lewisburg, 3; Yellow Springs and College Hill, 1.

*Oregon.*—Lakeview, 5.

*Utah.*—Ogden, 5; Frisco, 2; Salt Lake City, 1.9.

*Wyoming.*—Fort Bridger, 3.3.

### DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

[*Expressed in inches and tenths.*]

*Colorado.*—Pike's Peak, 1.8.

*Wyoming.*—Fort Bridger, 2.3.

### HAIL.

Yuma, Arizona: at 10.30 a. m. of the 3d a thunder-storm, with high wind and hail, set in. Hail fell from 10.58 to 11.05 a. m.; the stones were large and consisted of pressed snow, covered with a thick coat of clear ice. Maximum velocity of the wind during the storm, thirty miles per hour from the east.

Red Bluff, California: on the 16th heavy rain, with violent thunder and lightning, began at 8 p. m. Hail-stones, varying from one-fourth to an inch in diameter, fell to a depth of three inches, breaking many windows and damaging young orange, lemon, almond, and other fruit trees, vines, and plants. This hail storm was more violent than any that has occurred here for several years.

Tatoosh Island, Washington Territory: a thunder-storm, with heavy rain, set in at 6 a. m. of the 28th; rain, with hail squalls at intervals, continued until 10.20 p. m. Between 1 and 1.10 p. m. a heavy fall of hail occurred, the stones consisted of solid ice one-third of an inch in diameter.

Hail also fell in the various states and territories on the following dates:

*California.*—San Francisco, 16th; Susanville, 26th, 30th.

*Illinois.*—Windsor, 20th.

*Kansas.*—Wyandotte, 23d.

*Maine.*—Gardiner, 27th.

*Massachusetts.*—Boston and Amherst, 30th.

*Michigan.*—Pentwater, 17th.

*Nebraska.*—Genoa, 22d.

*New Jersey.*—Atlantic City, 30th.

*New Mexico.*—Fort Bayard, 3d.

*New York.*—Rochester and Palmyra, 1st; Factoryville and North Volney, 15th; Auburn, 17th.

*Ohio.*—Elyria, 1st.

*Oregon.*—Astoria, 28th; Albany, 31st.

*Texas.*—Silver Falls, 7th.

*Virginia.*—Rappahannock, 26th.

*Washington Territory.*—Walla Walla, 18th; Bainbridge Island, 20th; Fort Canby, 28th.

### SLEET.

Sleet occurred in the various states and territories, as follows:

*Dakota.*—Fort Buford, 19th.

*Michigan.*—Grand Haven, 1st.

*Nevada.*—Winnemucca, 18th.

*New York.*—Oswego, 1st, 2d, 15th.

*Ohio.*—Garrettsville, 1st; Wauseon, 27th.

*Pennsylvania.*—Erie, 1st.

*Texas.*—Silver Falls, 28th.

*Vermont.*—Burlington, 2d.

### RAIN FROM CLOUDLESS SKY.

The following is from the "Charlotte Chronicle" of October 21, 1886, published in Charlotte, North Carolina:

Citizens in the southeastern portion of the city have witnessed for three weeks or more a very strange phenomenon, and it is to the effect that every afternoon at 3 o'clock there is a rainfall in one particular spot, which lasts for half an hour. Between two trees at the hour named there falls a gentle rain while the sun is shining, and this has been witnessed every day during the past three weeks by the people in the neighborhood.

The Signal Service observer at Charlotte makes the following statement in regard to the phenomenon:

An unusual phenomenon was witnessed on the 21st; having been informed that for some weeks prior to date rain had been falling daily after 3 p. m. on a particular spot near two trees, corner of 9th and D streets, I visited the place and saw precipitation in the form of rain drops at 4.47 and 4.55 p. m., while the sun was shining brightly. On the 22d I again visited the place and from 4.05 to 4.25 p. m. a light shower of rain fell from a cloudless sky. The two trees referred to are red oaks, with limbs trimmed to within a few feet of the trunks, and are surrounded by many more of the same kind; they stand four or five feet apart and one hundred yards from the summit of a knoll at the base of which is a small ravine. Sometimes the precipitation falls over an area of half an acre but always appears to centre at these two trees and, when lightest, occurs there only.

## WINDS.

The most frequent directions of the wind during October, 1886, are shown on chart ii by the arrows flying with the wind; they are also given in the table of miscellaneous meteorological data. In New England, the middle and south Atlantic states, and in Florida they were generally from the north; in the Lake region, extreme northwest, and in the Missouri and upper Mississippi valleys they were mostly from the south or southwest; in the middle and southern Pacific coast regions they were generally westerly; in other portions of the country they were variable.

### HIGH WINDS.

[*In miles per hour.*]

Wind-velocities of fifty or more miles per hour were recorded during the month, as follows:

Mount Washington, New Hampshire, 76, sw., 1st; 60, w., 2d; 57, w., 4th; 50, nw., 5th; 70, w., 8th; 70, w., 9th; 50, w., 11th; 70, w., 12th; 60, s., 14th; 80, w. and nw., 15th; 78, nw., 16th; 50, sw., 20th; 80, sw., 21st; 89, w., 22d; 76, nw., 23d; 61, w., 25th.

Pike's Peak, Colorado, 52, w., 9th; 72, w., 10th; 76, sw., 19th; 54, w., 22d; 56, nw., 23d; 72, w., 30th; 68, sw., 31st.
Frisco, Utah, 50, sw., 10th.
Galveston, Texas, 55, nw., 12th.
Sandusky, Ohio, 53, w., 14th.
Detroit, Michigan, 52, w., 14th.
Grand Haven, Michigan, 52, n., 14th.
Port Huron, Michigan, 50, sw., 14th.
Saint Louis, Missouri, 52, sw., 14th.
Buffalo, New York, 63, sw., 14th.
North Platte, Nebraska, 60, s., 18th.
Fort Canby, Washington Territory, 50, s., 27th.

### LOCAL STORMS.

Atlantic City, New Jersey: light rain, with thunder and lightning, prevailed during the night of the 29–30th until 1 a. m., when the rain began falling very heavily and the electrical part of the storm became unusually violent. Hail-stones fell from 4 to 4.05 a. m., diameter one-half an inch. The total precipitation during the storm was 6.15 inches. The wind varied from ne. to nw., with a maximum velocity of twenty-five miles per hour from the north, at 11.30 a. m.

Block Island, Rhode Island: on the 30th light rain fell from 2 to 3.40 p. m., followed by high northeast winds, greatest velocity forty-two miles per hour. During the night the wind continued high and on the morning of the 31st, was blowing briskly from the southeast, backing to northeast, maximum velocity thirty-two miles per hour.

Boston, Massachusetts: rain fell during the greater part of the 30th, heavy in the afternoon and very heavy between 10 and 11 p. m. Large hail-stones fell from 10.30 to 10.45 p. m. The wind was from the northeast throughout the day, attaining between 9 p. m. of the 30th and 2.45 a. m. of the 31st the force of a heavy gale.

## NAVIGATION.

### STAGE OF WATER IN RIVERS.

In the following table are shown the danger-points at the various river stations; the highest and lowest depths for October, 1886, with the dates of occurrence, and the monthly ranges:

*Heights of rivers above low-water mark, October, 1886.*

[*Expressed in feet and tenths.*]

| Stations. | Danger-point on gauge. | Highest water. | | Lowest water. | | Monthly range. |
|---|---|---|---|---|---|---|
| | | Date. | Height. | Date. | Height. | |
| *Red River:* | | | | | | |
| Shreveport, Louisiana | 29.9 | 31 | 6.7 | 1 | 2.9 | 3.8 |
| *Arkansas River:* | | | | | | |
| Fort Smith, Arkansas | 22.0 | 1 | 3.2 | 18, 19, 20 | 1.4 | 1.8 |
| Little Rock, Arkansas | 23.0 | 1 | 5.0 | 26, 27, 28 | 1.3 | 3.7 |
| *Missouri River:* | | | | | | |
| Yankton, Dakota | 24.0 | 1, 2, 3 | 16.6 | 29, 30, 31 | 15.4 | 1.2 |
| Omaha, Nebraska | 18.0 | 1 to 5 | 7.0 | 31 | 6.2 | 0.8 |
| Leavenworth, Kansas | 20.0 | 4 | 6.2 | 19 | 4.9 | 1.3 |
| *Mississippi River:* | | | | | | |
| Saint Paul, Minnesota | 14.5 | 30 | 2.7 | 10 | 2.0 | 0.7 |
| La Crosse, Wisconsin | 24.0 | 1, 2 | 5.4 | 15 | 4.0 | 1.4 |
| Dubuque, Iowa | 16.0 | 24 | 6.2 | 13 | 4.3 | 1.9 |
| Keokuk, Iowa | 14.0 | 28 | 4.5 | 14, 16, 17 | 3.2 | 1.3 |
| Saint Louis, Missouri | 32.0 | 30, 31 | 7.0 | 18, 19 | 6.3 | 1.3 |
| Cairo, Illinois | 40.0 | 7 | 7.7 | 28, 29 | 4.0 | 3.7 |
| Memphis, Tennessee | 34.0 | 9, 10 | 6.2 | 30, 31 | 3.8 | 2.4 |
| Vicksburg, Mississippi | 41.0 | 14 | 4.5 | 31 | 0.6 | 3.9 |
| New Orleans, Louisiana | 13.0 | 12 | 5.7 | 31 | 1.6 | 4.1 |
| *Ohio River:* | | | | | | |
| Pittsburg, Pennsylvania | 22.0 | 1, 2, 3 | 6.3 | 14, 15 | 5.1 | 1.2 |
| Cincinnati, Ohio | 50.0 | 6 | 8.8 | 31 | 3.3 | 5.5 |
| Louisville, Kentucky | 25.0 | 7 to 10 | 5.0 | 27 to 31 | 2.7 | 2.3 |
| *Cumberland River:* | | | | | | |
| Nashville, Tennessee | 40.0 | 1 | 2.4 | 28 to 31 | 0.6 | 1.8 |
| *Tennessee River:* | | | | | | |
| Chattanooga, Tennessee | 33.0 | 29, 30 | 2.0 | 23 to 26 | 1.2 | 0.8 |
| *Monongahela River:* | | | | | | |
| Pittsburg, Pennsylvania | 29.0 | 1, 2, 3 | 6.3 | 14, 15 | 5.1 | 1.2 |
| *Savannah River:* | | | | | | |
| Augusta, Georgia | 32.0 | 1 to 4, 6 to 13 | 5.8 | 25 | 5.2 | 0.6 |
| *Mobile River:* | | | | | | |
| Mobile, Alabama | ..... | 12 | 19.1 | 27 | 15.4 | 3.7 |
| *Sacramento River:* | | | | | | |
| Red Bluff, California | ..... | 18 | 1.1 | 1, 15 | 0.3 | 0.8 |
| Sacramento, California | ..... | 20, 21 | 8.5 | 1 to 16 | 7.5 | 1.0 |
| *Willamette River:* | | | | | | |
| Portland, Oregon | ..... | 1, 2, 3 | 2.8 | 6 | —0.2 | 3.0 |
| *Colorado River:* | | | | | | |
| Yuma, Arizona | ..... | 1 | 15.5 | 26 to 31 | 15.0 | 0.5 |

Owing to the low stage of water in the Mississippi and Ohio Rivers during October, considerable difficulty was experienced by steamboat navigators. After the 27th, travel on these rivers was practically suspended. On the 20th the steamer "Gus Fowler" ran aground above Mound City and did not get free until 4 a. m of the 21st. The "Belle Memphis" was four days in making the trip from Saint Louis, Missouri, to Cairo, Illinois; the captain reports that she was aground several times and dragged the bottom of the river nearly the entire distance. The observer at Little Rock, Arkansas, reports that navigation was closed on the Arkansas River on the 11th on account of the low water. At Portland, Oregon, the Willamette River was lower on the 6th than it has been at any time since river observations have been taken.

### HIGH TIDES.

Owing to the storm that prevailed in the Gulf of Mexico from the 9th to the 12th very high tides were raised along the Gulf coast on the latter date from Cedar Keys, Florida, to Corpus Christi, Texas. Along the coast of Louisiana and eastern Texas the tide was higher and more destructive to life and property than any that has occurred within several years. The notes given below, in reference to this storm and the accompanying high tide, are from the reports of observers:

Sabine Pass, Jefferson county, Texas: this village is located at the mouth of the Sabine River, which forms the boundary line between Texas and Louisiana, the town is elevated only four feet above the mean tide and is bounded by a swamp on the west and by Lake Sabine on the northeast. On account of the heavy storm that prevailed over the Gulf of Mexico on the 9th, 10th, and 11th the tide was unusually high at Sabine Pass on the 11th, although the wind was light. During the morning of the 12th the wind blew a gale from the northwest and at 2 p. m. the water of the Gulf began flowing through the town; the water continued to rise rapidly, and in less than two hours nearly every house in the town was moved from its foundations and the country for fifteen miles inland overflowed with salt water. The loss of life was great, over one hundred persons being drowned. Many miles of rice fields were destroyed and hundreds of cattle drowned. The village of Johnson's Bayou, in Cameron county, Louisiana, is about fifteen miles east of Sabine Pass, and is located on a ridge extending along the Gulf coast, ten feet above the mean tide; behind the town is an extensive swamp. The tide was unusually high throughout the 11th and morning of the 12th; at 4 p. m. the wind was blowing with hurricane force and the water from the Gulf flowed over Johnson's Bayou and twenty miles inland, drowning fifty persons and completely destroying the village. Along the coast from Johnson's Bayou to Sabine Pass, the whole country was flooded, completely destroying all crops and drowning hundreds of cattle and horses.

Mobile, Alabama: on the 12th the wind shifted from the northeast to southeast and blew hard, causing a very high tide in Mobile Bay. Several washouts occurred on the Louisville and Nashville Railroad between New Orleans and Mobile. The observer at Pensacola, Florida, states that high easterly winds prevailed during the 11th, with tide higher than has been known for twenty-one years.

Manatee, Manatee county, Florida: on the 12th the highest tide of several years occurred, doing slight damage to the wharves on the north side of the river.

New Orleans, Louisiana: on the 11th and 12th very high easterly winds prevailed, causing Lake Pontchartrain to fill and overflow with water from the Gulf, submerging the lower portions of the city and all the country in the vicinity of the lake.

High tides were also reported on the following dates:
Eastport, Maine, 1st, 2d, 3d.
Smithville, North Carolina, 1st, 2d, 3d.
Augusta, Georgia, 1st, 8th.
Sandy Hook, New Jersey, 27th.

## COTTON REGION REPORTS.

In connection with the reports from the cotton districts the following table has been prepared, showing the average rainfall, mean maximum and mean minimum temperatures for each month of the growing season, from 1882 to 1886, inclusive.

The Chief Signal Officer is indebted to Mr. J. R. Dodge, statistician of the United States Department of Agriculture, for the information relative to the acreage and yield of cotton in the several states, as exhibited in the table. This table is interesting as showing the influence of rainfall and temperature on the cotton crop.

From the table it will be seen that the yield of cotton in all districts in 1882 was greater than in either of the three succeeding years; this is undoubtedly due to the large precipitation that fell in that year throughout the cotton districts during July and August, the two months during which the soil is most affected by evaporation. In 1884, in Louisiana and Texas, the rainfall of these months was very small and the yield of cotton per acre was correspondingly small. The deficient rainfalls that are noted in the table during other months appear to have but little effect upon the cotton yield when they are counteracted by large rainfalls during July and August:

*Rainfall and mean maximum and mean minimum temperatures of the Cotton belt for the years* 1882, 1883, 1884, 1885, *and* 1886; *also the acreage and yield during the first four years mentioned.*

| Districts. | | Rainfall. | | | | | | | Mean maximum temperature. | | | | | | | Mean minimum temperature. | | | | | | | Acres. | Bales. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | | |
| | | Inches | Inches | Inches | Inches | Inches | Inches | Inches | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | | |
| North Carolina: Wilmington | 1882 | 3.88 | 2.52 | 1.97 | 5.90 | 6.24 | 3.49 | 3.08 | 74.2 | 79.0 | 90.0 | 90.2 | 87.8 | 81.7 | 75.2 | 50.0 | 54.6 | 66.2 | 67.7 | 67.8 | 62.8 | 53.5 | 1,050,543 | 463,000 |
| | 1883 | 4.97 | 2.33 | 7.30 | 3.16 | 2.96 | 9.36 | 2.32 | 70.9 | 82.6 | 88.8 | 93.2 | 88.7 | 79.7 | 75.6 | 48.7 | 54.6 | 66.5 | 70.2 | 67.5 | 61.2 | 55.2 | 1,050,543 | 398,200 |
| | 1884 | 3.17 | 3.20 | 6.01 | 6.01 | 3.75 | 3.32 | 0.64 | 69.9 | 82.4 | 84.4 | 89.9 | 88.3 | 85.8 | 79.8 | 46.8 | 59.0 | 62.5 | 68.8 | 66.7 | 62.1 | 55.1 | 1,061,048 | 404,100 |
| | 1885 | ..... | 6.76 | 4.87 | 4.35 | 4.05 | 2.99 | ..... | ..... | 79.9 | 87.6 | 91.9 | 88.4 | 81.3 | ..... | ..... | 56.2 | 64.2 | 68.3 | 67.3 | 60.5 | ..... | 1,071,658 | 407,230 |
| | 1886 | ..... | 4.94 | 7.78 | 8.43 | 7.42 | 2.42 | 0.70 | ..... | 83.1 | 85.2 | 89.3 | 87.4 | 84.4 | 74.6 | ..... | 59.0 | 66.4 | 69 2 | 68.7 | 64.8 | 49.7 | ..... | ..... |
| Means | | 4.01 | 3.96 | 5.59 | 5.57 | 4.88 | 4.32 | 1.68 | 71.7 | 81.4 | 91.2 | 90.9 | 88.1 | 82.6 | 76.3 | 48.5 | 56.7 | 65.2 | 68.8 | 67.6 | 62.3 | 53.6 | ..... | ..... |
| South Carolina: Augusta ... Charleston | 1882 | 2.85 | 2.32 | 4.52 | 6.11 | 5.16 | 4.58 | 3.52 | 77.8 | 82.1 | 90.2 | 90.0 | 89.4 | 84.3 | 77.8 | 54.6 | 57.4 | 67.5 | 68.6 | 68.8 | 64.6 | 56.3 | 1,587,244 | 630,000 |
| | 1883 | 5.08 | 3.88 | 5.01 | 2.67 | 4.39 | 2.35 | 1.46 | 76.6 | 83.1 | 90.3 | 94.5 | 90.2 | 86.5 | 78.5 | 54.8 | 58.4 | 68.9 | 72.4 | 68.3 | 62.3 | 55.9 | 1,618,989 | 469,600 |
| | 1884 | 4.48 | 2.62 | 6.31 | 5.41 | 4.78 | 4.43 | 0.25 | 72.3 | 85.8 | 85.0 | 92.1 | 89.1 | 86.6 | 81.7 | 54.7 | 61.3 | 64.2 | 70.9 | 67.6 | 65.0 | 56.8 | 1,716,128 | 511,800 |
| | 1885 | ..... | 4.44 | 5.45 | 5.28 | 7.85 | 3.92 | 4.82 | ..... | 82.3 | 89.5 | 92.3 | 90.4 | 82.7 | 70.8 | ..... | 58.7 | 67.1 | 70.0 | 69.5 | 64.0 | 50.3 | 1,733,289 | 554,652 |
| | 1886 | ..... | 3.70 | 9.08 | 5.73 | 4.34 | 1.98 | 0.46 | ..... | 84.5 | 86.8 | 90.1 | 88.8 | 85.7 | 76.0 | ..... | 59.1 | 68.0 | 69.5 | 69.4 | 65.8 | 51.0 | ..... | ..... |
| Means | | 4.14 | 3.39 | 6.07 | 5.04 | 5.30 | 3.45 | 2.10 | 75.6 | 83.6 | 88.4 | 91.8 | 89.6 | 85.2 | 77.0 | 54.7 | 59.0 | 67.1 | 70.3 | 68.7 | 64.3 | 54.1 | ..... | ..... |
| Georgia: Atlanta... Savannah | 1882 | 4.11 | 2.52 | 4.41 | 5.83 | 6.10 | 4.22 | 3.50 | 78.7 | 81.8 | 89.2 | 89.4 | 88.2 | 81.7 | 78.1 | 57.5 | 57.6 | 68.3 | 68.9 | 69.2 | 64.7 | 58.5 | 2,844,305 | 942,000 |
| | 1883 | 6.02 | 3.14 | 4.41 | 2.33 | 5.33 | 1.91 | 1.46 | 77.3 | 82.3 | 92.2 | 94.4 | 90.0 | 84.9 | 79.8 | 54.5 | 58.0 | 69.0 | 70.0 | 69.2 | 63.3 | 59.5 | 2,872,748 | 752,500 |
| | 1884 | 4.16 | 1.66 | 8.59 | 4.88 | 3.12 | 1.43 | 0.47 | 74.1 | 86.3 | 84.1 | 91.0 | 89.2 | 88.0 | 82.4 | 51.8 | 62.4 | 63.8 | 70.6 | 68.1 | 64.7 | 57.7 | 2,958,930 | 807,400 |
| | 1885 | ..... | 4.69 | 4.02 | 4.73 | 6.12 | 7.08 | 4.61 | ..... | 81.9 | 90.2 | 92.1 | 89.8 | 83.1 | 70.8 | ..... | 59.3 | 68.5 | 70.6 | 70.6 | 64.3 | 51.5 | 3,047,698 | 960,025 |
| | 1886 | ..... | 4.42 | 8.28 | 6.60 | 4.88 | 1.46 | 0.56 | ..... | 84.3 | 88.4 | 89.5 | 89.5 | 86.7 | 77.1 | ..... | 60.5 | 69.2 | 70.4 | 70.6 | 67.0 | 53.1 | ..... | ..... |
| Means | | 4.76 | 3.29 | 5.94 | 4.87 | 5.11 | 3.22 | 2.12 | 76.7 | 83.3 | 88.8 | 91.3 | 89.3 | 85.5 | 77.6 | 54.6 | 59.6 | 67.8 | 70.1 | 69.5 | 64.8 | 56.1 | ..... | ..... |
| Alabama: Montgomery Mobile | 1882 | 7.92 | 3.85 | 3.04 | 5.62 | 3.98 | 2.24 | 2.31 | 77.3 | 82.6 | 93.1 | 89.5 | 89.4 | 85.3 | 80.7 | 57.2 | 58.2 | 69.1 | 67.9 | 69.3 | 62.4 | 58.1 | 2,534,388 | 810,000 |
| | 1883 | 8.27 | 2.76 | 4.78 | 1.51 | 2.74 | 0.72 | 1.81 | 79.5 | 84.7 | 90.9 | 96.3 | 92.9 | 88.8 | 82.1 | 55.4 | 57.3 | 69.4 | 70.4 | 68.8 | 61.8 | 59.1 | 2,610,420 | 630,400 |
| | 1884 | 3.63 | 2.59 | 6.72 | 5.33 | 2.16 | 0.33 | 1.45 | 75.3 | 86.0 | 86.5 | 92.8 | 90.9 | 90.2 | 82.7 | 51.2 | 61.0 | 64.7 | 70.8 | 66.8 | 66.0 | 57.3 | 2,740,941 | 648,700 |
| | 1885 | ..... | 5.17 | 3.08 | 4.73 | 3.20 | 4.84 | 1.86 | ..... | 83.2 | 91.9 | 93.0 | 91.7 | 84.5 | 70.1 | ..... | 61.3 | 71.9 | 70.5 | 70.2 | 66.5 | 58.2 | 2,795,760 | 760,447 |
| | 1886 | ..... | 2.91 | 7.45 | 4.06 | 4.00 | 1.18 | 0.30 | ..... | 84.7 | 87.9 | 90.9 | 90.7 | 87.5 | 78.3 | ..... | 59.0 | 67.4 | 69.1 | 70.0 | 66.2 | 53.6 | ..... | ..... |
| Means | | 6.61 | 3.46 | 5.01 | 4.25 | 3.22 | 1.86 | 1.53 | 77.4 | 84.2 | 90.1 | 92.5 | 91.1 | 87.3 | 78.8 | 54.6 | 59.4 | 68.5 | 69.7 | 69.0 | 64.6 | 57.3 | ..... | ..... |
| Louisiana: New Orleans | 1882 | 5.63 | 5.57 | 2.43 | 8.30 | 8.38 | 2.64 | 2.64 | 81.9 | 84.4 | 90.6 | 90.4 | 89.8 | 86.7 | 81.9 | 59.9 | 61.1 | 72.0 | 71.3 | 72.0 | 67.7 | 62.0 | 887,524 | 560,000 |
| | 1883 | 6.99 | 3.96 | 8.65 | 3.30 | 2.70 | 1.22 | 2.60 | 80.0 | 84.8 | 90.2 | 93.2 | 91.9 | 88.4 | 84.9 | 59.6 | 62.9 | 71.7 | 74.4 | 70.4 | 66.2 | 65.9 | 931,900 | 490,200 |
| | 1884 | 5.54 | 9.20 | 4.19 | 1.62 | 1.93 | 2.67 | 2.93 | 75.4 | 82.6 | 89.4 | 95.3 | 92.4 | 90.6 | 81.3 | 56.7 | 65.0 | 68.1 | 74.9 | 69.3 | 69.3 | 59.0 | 922,581 | 485,200 |
| | 1885 | ..... | 3.12 | 3.01 | 3.80 | 3.58 | 5.09 | 1.23 | ..... | 82.9 | 92.9 | 94.2 | 91.1 | 85.0 | 73.6 | ..... | 61.4 | 69.4 | 73.7 | 72.6 | 67.7 | 50.3 | 1,005,613 | 487,722 |
| | 1886 | ..... | 1.11 | 11.20 | 4.26 | 2.69 | 4.14 | 1.40 | ..... | 86.6 | 89.3 | 91.5 | 92.7 | 86.8 | 77.4 | ..... | 65.2 | 70.3 | 71.2 | 71.4 | 68.8 | 55.0 | ..... | ..... |
| Means | | 6.05 | 4.59 | 5.90 | 4.26 | 3.86 | 3.13 | 2.16 | 82.4 | 84.3 | 90.5 | 92.9 | 91.4 | 87.5 | 79.8 | 58.7 | 63.1 | 70.3 | 73.1 | 71.1 | 67.9 | 58.4 | ..... | ..... |
| Mississippi: Vicksburg Mobile | 1882 | 7.92 | 5.85 | 2.02 | 8.18 | 4.31 | 1.56 | 3.28 | 78.8 | 82.6 | 94.0 | 89.9 | 89.6 | 85.8 | 80.7 | 57.0 | 60.0 | 68.6 | 68.8 | 69.8 | 62.2 | 57.5 | 2,233,844 | 1,064,000 |
| | 1883 | 7.86 | 2.78 | 4.98 | 2.43 | 2.46 | 0.88 | 3.76 | 78.9 | 84.0 | 91.6 | 94.8 | 93.1 | 90.9 | 81.6 | 56.3 | 59.0 | 69.8 | 71.6 | 69.3 | 62.0 | 60.6 | 2,278,521 | 901,300 |
| | 1884 | 4.08 | 6.37 | 4.92 | 4.50 | 2.51 | 1.50 | 1.56 | 75.3 | 82.8 | 87.8 | 93.8 | 91.3 | 90.7 | 81.7 | 53.3 | 61.7 | 67.0 | 72.6 | 67.7 | 66.7 | 51.5 | 2,392,447 | 883,200 |
| | 1885 | ..... | 4.55 | 2.53 | 4.91 | 2.38 | 6.96 | 1.63 | ..... | 82.9 | 92.2 | 93.5 | 91.8 | 85.0 | 72.5 | ..... | 62.3 | 76.6 | 70.4 | 70.1 | 67.1 | 49.3 | 2,535,994 | 1,019,470 |
| | 1886 | ..... | 2.17 | 7.97 | 3.21 | 2.88 | 2.98 | 0.58 | ..... | 84.9 | 87.6 | 91.5 | 91.8 | 87.8 | 77.4 | ..... | 60.4 | 70.0 | 70.8 | 70.9 | 67.7 | 52.7 | ..... | ..... |
| Means | | 6.62 | 4.34 | 4.48 | 4.65 | 2.91 | 2.78 | 2.16 | 77.7 | 83.4 | 90.6 | 92.7 | 91.5 | 88.0 | 78.8 | 55.5 | 60.7 | 70.4 | 70.8 | 69.6 | 65.1 | 54.3 | ..... | ..... |
| Tennessee: Memphis | 1882 | 5.29 | 7.58 | 2.89 | 5.45 | 4.30 | 1.69 | 2.02 | 74.9 | 77.7 | 90 4 | 88.0 | 87.1 | 82.7 | 78.3 | 54.0 | 56.3 | 67.0 | 67.1 | 67.2 | 60.3 | 54.6 | 815,760 | 337,000 |
| | 1883 | 6.93 | 4.59 | 4.52 | 4.00 | 3.41 | 1.05 | 4.22 | 74.9 | 80.3 | 89.2 | 91.4 | 87.5 | 85.3 | 76.3 | 52.7 | 55.4 | 67.1 | 68.3 | 65.0 | 56.3 | 54.7 | 807,602 | 310,700 |
| | 1884 | 5.98 | 3.77 | 5.29 | 4.86 | 1.76 | 2.06 | 2.25 | 69.3 | 80.5 | 83.3 | 90.4 | 89.0 | 88.1 | 78.2 | 49.5 | 58.2 | 65.4 | 69.1 | 64.7 | 64.3 | 54.4 | 815,678 | 313,800 |
| | 1885 | ..... | 2.82 | 4.70 | 2.88 | 1.10 | 4.24 | 2.09 | ..... | 78.5 | 89.2 | 91.5 | 90.7 | 82.9 | 68.6 | ..... | 55.9 | 67.6 | 70.4 | 67.2 | 61.8 | 46.1 | 864,618 | 321,638 |
| | 1886 | ..... | 3.49 | 7.05 | 2.21 | 3.89 | 3.56 | 0.60 | ..... | 82.4 | 85.1 | 90.5 | 89.2 | 84.5 | 74.8 | ..... | 57.7 | 65.4 | 67.1 | 68.2 | 63.2 | 48.1 | ..... | ..... |
| Means | | 6.07 | 4.45 | 4.89 | 3.88 | 2.89 | 2.52 | 2.25 | 73.0 | 79.9 | 87.4 | 90.4 | 88.7 | 84.7 | 75.2 | 52.1 | 56.7 | 66.3 | 68.4 | 66.5 | 61.2 | 51.6 | ..... | ..... |
| Arkansas: Little Rock | 1882 | 4.74 | 11.04 | 1.58 | 3.08 | 3.44 | 2.32 | 4.34 | 75.9 | 78.7 | 91.3 | 89.2 | 88.3 | 83.3 | 78.3 | 51.9 | 53.6 | 64.2 | 66.0 | 65.3 | 59.0 | 54.5 | 1,110,790 | 697,000 |
| | 1883 | 6.78 | 4.21 | 3.52 | 6.66 | 3.41 | 0.63 | 1.79 | 75.3 | 82.0 | 90.0 | 94.2 | 91.9 | 87.7 | 77.2 | 53.9 | 54.6 | 67.2 | 64.9 | 65.6 | 53.3 | 50.0 | 1,188,545 | 518,500 |
| | 1884 | 6.66 | 5.59 | 3.25 | 2.80 | 1.54 | 2.96 | 0.99 | 72.2 | 79.4 | 87.7 | 94.7 | 90.1 | 88.5 | 77.3 | 47.3 | 58.2 | 65.8 | 70.6 | 64.9 | 63.0 | 53.0 | 1,259,858 | 531,400 |
| | 1885 | ..... | 2.51 | 2.71 | 1.95 | 1.49 | 1.91 | 1.01 | ..... | 80.0 | 90.1 | 94.0 | 92.6 | 84.9 | 72.0 | ..... | 54.5 | 66.3 | 70.4 | 67.1 | 62.2 | 45.7 | 1,348,048 | 610,666 |
| | 1886 | ..... | 0.80 | 5.82 | 2.75 | 2.05 | 5.41 | 1.11 | ..... | 85.5 | 86.7 | 91.9 | 92.7 | 86.7 | 73.5 | ..... | 60.0 | 66.3 | 68.9 | 68.9 | 64.1 | 50.3 | ..... | ..... |
| Means | | 6.06 | 4.84 | 3.38 | 3.33 | 2.39 | 2.65 | 1.85 | 74.5 | 81.1 | 89.2 | 92.8 | 91.1 | 86.2 | 76.1 | 51.0 | 56.2 | 66.0 | 68.2 | 66.4 | 60.3 | 50.7 | ..... | ..... |
| Texas: Galveston | 1882 | 1.58 | 5.25 | 0.90 | 3.74 | 5.42 | 3.50 | 5.73 | 82.1 | 83.9 | 92.7 | 94.0 | 91.7 | 86.8 | 82.6 | 57.9 | 59.9 | 70.0 | 71.3 | 70.2 | 64.8 | 60.4 | 2,810,113 | 1,336,000 |
| | 1883 | 1.90 | 2.18 | 3.48 | 2.15 | 0.93 | 2.58 | 2.55 | 79.4 | 86.6 | 93.1 | 94.0 | 96.3 | 88.7 | 83.6 | 57.2 | 66.2 | 72.6 | 73.7 | 73.4 | 65.1 | 63.4 | 3,034,922 | 1,118,000 |
| | 1884 | 4.54 | 12.20 | 3.66 | 0.23 | 1.61 | ..... | ..... | 75.3 | 82.9 | 90.8 | 97.6 | 93.9 | ..... | ..... | 51.8 | 61.5 | 67.9 | 73.8 | 66.6 | ..... | ..... | 3,186,668 | 995,400 |
| | 1885 | ..... | 6.49 | ..... | 2.58 | 1.34 | 5.26 | 1.65 | ..... | 82.1 | ..... | 94.0 | 94.2 | 87.4 | 77.2 | ..... | 61.1 | ..... | 70.9 | 71.9 | 67.3 | 54.4 | 3,505,335 | 1,332,027 |
| | 1886 | ..... | 0.26 | 2.30 | 1.72 | 2.59 | 6.75 | 1.41 | ..... | 87.9 | 91.8 | 94.7 | 95.0 | 88.2 | 79.0 | ..... | 64.7 | 70.4 | 73.5 | 73.1 | 69.5 | 57.3 | ..... | ..... |
| Means | | 2.67 | 5.28 | 2.58 | 2.08 | 2.38 | 4.52 | 2.84 | 78.9 | 84.7 | 92.1 | 94.9 | 94.2 | 87.8 | 80.6 | 55.6 | 62.7 | 70.2 | 72.6 | 71.0 | 66.7 | 58 9 | ..... | ..... |

In the table on page 292 are given the means of the maximum and minimum temperatures and the average rainfall for the cotton districts during the month of October.

For the purpose of comparison, the averages for these districts during the four preceding years are also given.

The rainfall of the month, as compared with the averages of four years, is largely deficient in all districts of the cotton region. The means of the maximum and minimum temperatures are also below the normal in nearly all districts:

*Table of miscellaneous meteorological data for October, 1886—Signal Service observations.*

| Stations. | Elevation above sea-level. | Atmospheric pressure (in inches and hundredths). Mean actual barometer. | Departure from normal. | Mean reduced barometer. | Extremes. Highest barometer. | Date. | Lowest barometer. | Date. | Monthly range of barometer. | Temperature of the air (in degrees Fahrenheit). Monthly mean. | Departure from normal. | Extremes. Max. | Date. | Mean max. | Min. | Date. | Mean min. | Monthly range. | Daily ranges. Greatest. | Date. | Least. | Date. | Mean rel. humidity. | Mean dew-point. | Precipitation. | Departure from normal. | Winds. Total movement. | Prevailing direction. | Maximum velocity. Miles p. h. | Direction. | Date. | No. of rainy days. | No. of cloudy days. | No. of fair days. | No. of clear days. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *New England.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Eastport | 61 | ........ | ........ | ........ | ........ | ... | ........ | ... | ...... | ........ | ........ | ...... | ... | ...... | ...... | ... | ...... | ...... | ...... | ... | ...... | ... | ...... | ...... | ...... | ...... | ...... | ...... | ... | ...... | ... | ... | ... | ... | ... |
| Portland | 99 | 30.04 | +.08 | 30.14 | 30.60 | 19 | 29.60 | 15 | 1.00 | 47.9 | −2.3 | 78.5 | 9 | 56.2 | 27.6 | 17 | 40.2 | 50.9 | 31.7 | 9 | 4.1 | 27 | 74.1 | 39.4 | 6.70 | +3.09 | 5,781 | n. | 31 | s. | 15 | 10 | 8 | 12 | 11 |
| Mount Washington | 6,279 | 23.84 | ........ | 30.16 | 30.68 | 19 | 29.51 | 15 | 1.17 | 31.5 | +1.3 | 48.8 | 12 | 37.9 | −0.8 | 17 | 24.6 | 49.6 | 28.4 | 15 | 4.4 | 11 | 86.8 | 27.5 | 5.09 | −2.51 | 21,470 | w. | 89 | w. | 22 | 17 | 4 | 14 | 13 |
| Boston | 125 | 30.02 | +.04 | 30.14 | 30.57 | 19 | 29.66 | 15 | 0.91 | 51.5 | −0.5 | 79.7 | 9 | 59.6 | 27.2 | 17 | 44.3 | 52.5 | 27.0 | 9 | 3.4 | 27 | 74.7 | 42.8 | 3.27 | −1.01 | 8,558 | w. | 40 | e. | 31 | 9 | 6 | 9 | 16 |
| Block Island | 27 | 30.12 | ........ | 30.14 | 30.54 | 19 | 29.75 | 1 | 0.80 | 54.8 | −0.3 | 71.0 | 9 | 60.1 | 35.1 | 17 | 49.3 | 35.9 | 20.5 | 1 | 3.9 | 27 | 84.3 | 49.9 | 4.71 | −0.43 | 11,349 | ne. | 42 | ne. | 30 | 7 | 9 | 11 | 11 |
| Narragansett Pier | ...... | ........ | ........ | ........ | ........ | ... | ........ | ... | ...... | 53.3 | ........ | 78.0 | 9 | 62.1 | 25.0 | 17 | 44.5 | 53.0 | ...... | ... | ...... | ... | ...... | ...... | 3.95 | ........ | ........ | ...... | ... | ...... | ... | 9 | ... | ... | ... |
| New Haven | 107 | 30.05 | ........ | 30.15 | 30.55 | 19 | 29.75 | 1 | 0.81 | 52.8 | −0.6 | 73.4 | 9 | 63.2 | 25.1 | 17 | 43.6 | 53.3 | 34.9 | 9 | 8.9 | 30 | 74.6 | 43.9 | 1.95 | −1.92 | 5,708 | ne. | 26 | ne. | 30 | 9 | 9 | 9 | 13 |
| New London | 47 | 30.09 | +.02 | 30.13 | 30.54 | 19 | 29.73 | 1 | 0.81 | 53.4 | −0.2 | 75.0 | 9 | 62.4 | 29.9 | 17 | 45.1 | 46.1 | 28.8 | 9 | 5.8 | 27 | 77.5 | 46.0 | 4.14 | −0.16 | 4,808 | ne. | 22 | s. | 14 | 10 | 8 | 14 | 9 |
| Edgartown | | ........ | ........ | ........ | ........ | ... | ........ | ... | ...... | ........ | ........ | ...... | ... | ...... | ...... | ... | ...... | ...... | ...... | ... | ...... | ... | ...... | ...... | ...... | ...... | ...... | ...... | ... | ...... | ... | ... | ... | ... | ... |
| *Mid. Atlantic States.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Albany | 83 | 30.10 | +.08 | 30.18 | 30.58 | 19 | 29.72 | 15 | 0.87 | 52.2 | +1.0 | 78.6 | 9 | 62.4 | 30.4 | 24 | 43.0 | 48.2 | 31.6 | 7 | 7.3 | 30 | 72.2 | 42.6 | 2.43 | +0.86 | 4,241 | s. | 27 | se. | 14 | 10 | 8 | 14 | 9 |
| New York City | 108 | 30.00 | +.06 | 30.17 | 30.52 | 19 | 29.79 | 1 | 0.73 | 56.5 | +1.0 | 82.5 | 9 | 65.4 | 34.6 | 17 | 49.9 | 47.9 | 29.2 | 9 | 5.1 | 29 | 69.8 | 45.7 | 3.90 | +0.58 | 6,048 | ne. | 28 | nw. | 16 | 7 | 8 | 8 | 15 |
| Philadelphia | 117 | 30.06 | +.06 | 30.17 | 30.53 | 19 | 29.81 | 1 | 0.73 | 58.2 | +2.0 | 83.7 | 10 | 67.8 | 36.8 | 17 | 50.6 | 46.9 | 20.7 | 12 | 4.4 | 30 | 67.2 | 45.9 | 1.89 | −1.00 | 7,015 | nw. | 28 | nw. | 15 | 6 | 8 | 7 | 16 |
| Atlantic City | 13 | 30.14 | +.04 | 30.14 | 30.49 | 19 | 29.78 | 1 | 0.70 | 58.1 | +1.1 | 73.9 | 9 | 65.5 | 36.2 | 17 | 51.0 | 37.7 | 26.5 | 1 | 5.4 | 31 | 82.2 | 52.2 | 8.16 | +5.34 | 6,526 | nw. | 25 | n. | 30 | 7 | 7 | 7 | 17 |
| Sandy Hook | 26 | 30.13 | +.04 | 30.15 | 30.52 | 19 | 29.77 | 1 | 0.75 | 57.4 | +0.6 | 79.0 | 12 | 63.8 | 38.0 | 17 | 51.3 | 41.0 | 22.5 | 1 | 4.6 | 27 | 78.5 | 50.2 | 6.70 | +3.39 | 12,943 | ne. | 48 | nw. | 15 | 7 | 6 | 15 | 10 |
| Cape Henlopen | ...... | ........ | ........ | ........ | ........ | ... | ........ | ... | ...... | 63.0 | ........ | 76.6 | 11 | 69.0 | 45.6 | 30 | 57.0 | 31.0 | 22.1 | 18 | 4.9 | 25 | ...... | ...... | 2.77 | ........ | ........ | ...... | ... | ...... | ... | 6 | ... | ... | ... |
| Baltimore | 45 | 30.13 | +.05 | 30.16 | 30.49 | 19 | 29.81 | 1 | 0.68 | 58.6 | +0.9 | 82.3 | 12 | 68.5 | 36.4 | 17 | 50.3 | 45.9 | 28.2 | 12 | 6.2 | 14 | 66.1 | 45.9 | 1.39 | −1.71 | 3,796 | nw. | 20 | nw. | 15 | 7 | 5 | 10 | 16 |
| Ocean City | ...... | ........ | ........ | ........ | ........ | ... | ........ | ... | ...... | 60.8 | ........ | 76.5 | 9 | 66.9 | 43.0 | 2 | 54.7 | 33.5 | 19.5 | 12 | 3.4 | 31 | ...... | ...... | 1.71 | ........ | ........ | ...... | ... | ...... | ... | 4 | ... | ... | ... |
| Washington City | 106 | 30.08 | +.07 | 30.18 | 30.50 | 17 | 29.80 | 14 | 0.70 | 57.6 | −0.1 | 83.2 | 13 | 68.6 | 33.3 | 17 | 46.7 | 49.9 | 33.9 | 10 | 8.9 | 14 | 70.0 | 46.5 | 1.20 | −2.10 | 3,602 | nw. | 24 | nw. | 1 | 8 | 6 | 6 | 19 |
| Cape Henry | 16 | 30.15 | +.05 | 30.15 | 30.46 | 17 | 29.85 | 28 | 0.61 | 62.5 | −0.5 | 78.7 | 12 | 68.4 | 47.0 | 30 | 56.9 | 31.7 | 23.3 | 12 | 2.5 | 24 | 76.6 | 54.5 | 0.63 | −3.18 | 9,920 | nw. | 44 | nw. | 16 | 2 | 1 | 14 | 16 |
| Chincoteague | 8 | 30.16 | +.06 | 30.15 | 30.48 | 17 | 29.81 | 28 | 0.67 | 61.0 | +0.2 | 79.0 | 12 | 67.6 | 43.5 | 17 | 54.6 | 35.5 | 21.6 | 1 | 5.5 | 31 | 78.5 | 53.8 | 1.91 | −1.01 | 7,615 | nw. | 34 | nw. | 30 | 5 | 2 | 12 | 17 |
| Lynchburg | 652 | 29.50 | +.08 | 30.18 | 30.51 | 17 | 29.83 | 14 | 0.68 | 56.2 | −2.0 | 85.5 | 12 | 71.3 | 33.7 | 17 | 44.0 | 51.8 | 40.4 | 12 | 5.7 | 27 | 76.6 | 47.6 | 1.01 | −2.23 | 1,921 | e. | 16 | nw. | 30 | 4 | 2 | 10 | 19 |
| Norfolk | 30 | 30.15 | +.07 | 30.16 | 30.47 | 17 | 29.86 | 28 | 0.61 | 61.3 | +0.1 | 80.6 | 12 | 70.6 | 44.3 | 30 | 54.3 | 36.3 | 25.3 | 12 | 8.4 | 6 | 73.9 | 51.8 | 1.31 | −2.37 | 4,148 | ne. | 21 | ne. | 6 | 3 | 4 | 12 | 15 |
| *South Atlantic States.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Charlotte | 808 | 29.35 | +.09 | 30.18 | 30.46 | 17 | 29.85 | 14 | 0.62 | 60.4 | −2.3 | 84.5 | 14 | 73.1 | 36.6 | 30 | 47.2 | 47.9 | 35.6 | 4 | 15.7 | 26 | 81.8 | 54.3 | 0.34 | −3.32 | 3,158 | ne. | 16 | s. | 26 | 1 | 2 | 7 | 22 |
| Fort Macon | 11 | 30.16 | +.07 | 30.14 | 30.40 | 17 | 29.86 | 28 | 0.54 | 64.8 | −1.9 | 80.9 | 15 | 71.7 | 42.2 | 30 | 59.3 | 38.7 | 20.1 | 31 | 7.9 | 27 | 80.2 | 58.1 | 0.60 | −3.15 | 9,193 | ne. | 36 | n. | 2 | 3 | 1 | 9 | 21 |
| Hatteras | 12 | 30.16 | +.08 | 30.15 | 30.44 | 17 | 29.86 | 28 | 0.58 | 65.3 | −1.6 | 79.1 | 14 | 70.7 | 48.5 | 30 | 59.5 | 30.6 | 18.4 | 14 | 7.4 | 5 | 82.3 | 59.5 | 0.98 | −6.01 | 6,054 | n. | 23 | n. | 2 | 4 | 4 | 12 | 15 |
| Kitty Hawk | 9 | ........ | ........ | ........ | ........ | ... | ........ | ... | ...... | ........ | ........ | ...... | ... | ...... | ...... | ... | ...... | ...... | ...... | ... | ...... | ... | ...... | ...... | ...... | ...... | ...... | ...... | ... | ...... | ... | ... | ... | ... | ... |
| New River Inlet | ...... | ........ | ........ | ........ | ........ | ... | ........ | ... | ...... | 65.6 | ........ | 83.5 | 15 | 76.4 | 40.0 | 30 | 54.9 | 43.5 | ...... | ... | ...... | ... | ...... | ...... | 0.45 | −2.94 | ........ | ...... | ... | ...... | ... | 2 | ... | ... | ... |
| Smithville | 34 | 30.13 | +.07 | 30.14 | 30.37 | 17 | 29.87 | 28 | 0.50 | 63.5 | −2.2 | 82.8 | 15 | 72.4 | 35.9 | 30 | 52.9 | 46.9 | 28.7 | 7 | 11.2 | 27 | 78.5 | 56.3 | 1.16 | −4.29 | 6,080 | n. | 20 | n. | 16 | 3 | 3 | 8 | 20 |
| Wash Woods | ...... | ........ | ........ | ........ | ........ | ... | ........ | ... | ...... | 64.9 | ........ | 80.0 | 14 | 72.8 | 42.0 | 31 | 56.9 | 38.0 | ...... | ... | ...... | ... | ...... | ...... | 0.55 | ........ | ........ | ...... | ... | ...... | ... | 2 | ... | ... | ... |
| Wilmington | 53 | 30.11 | +.03 | 30.14 | 30.40 | 17 | 29.87 | 28 | 0.54 | 64.0 | −0.1 | 87.1 | 13 | 76.5 | 38.4 | 30 | 53.3 | 48.7 | 28.9 | 12 | 16.0 | 27 | 71.3 | 53.3 | 0.48 | −3.61 | 3,879 | ne. | 16 | ne. | 2 | 2 | 2 | 10 | 19 |
| Charleston | 52 | 30.12 | +.09 | 30.14 | 30.34 | 17 | 29.90 | 1 | 0.45 | 66.5 | −0.6 | 86.1 | 15 | 75.1 | 44.9 | 30 | 59.6 | 41.2 | 24.0 | 31 | 9.0 | 10 | 75.0 | 57.7 | 0.01 | −4.89 | 5,647 | ne. | 26 | ne. | 19 | 1 | 4 | 12 | 15 |
| Augusta | 183 | 30.01 | +.08 | 30.17 | 30.39 | 20 | 29.93 | 14 | 0.46 | 61.7 | −2.8 | 86.0 | 12 | 77.3 | 33.8 | 30 | 50.1 | 52.2 | 36.6 | 31 | 14.2 | 2 | 82.4 | 55.5 | 0.14 | −2.12 | 2,493 | n. | 17 | ne. | 2 | 2 | 2 | 5 | 24 |
| Savannah | 87 | 30.08 | +.08 | 30.14 | 30.32 | 17 | 29.91 | 1 | 0.41 | 66.2 | −0.7 | 83.3 | 1 | 74.3 | 41.8 | 30 | 58.5 | 41.5 | 21.1 | 31 | 8.4 | 11 | 76.6 | 57.8 | 0.90 | −3.06 | 4,743 | e. | 27 | e. | 19 | 7 | 4 | 10 | 17 |
| Jacksonville | 43 | 30.09 | +.07 | 30.10 | 30.24 | 19 | 29.93 | 1 | 0.31 | 68.9 | −1.1 | 87.3 | 15 | 77.9 | 44.0 | 31 | 62.5 | 43.3 | 24.5 | 31 | 8.4 | 10 | 80.3 | 61.9 | 2.47 | −3.76 | 4,571 | ne. | 20 | ne. | 2 | 10 | 6 | 12 | 13 |
| *Florida Peninsula.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cedar Keys | 22 | 30.10 | +.06 | 30.08 | 30.25 | 30 | 29.86 | 11 | 0.39 | 71.2 | −2.8 | 85.1 | 14 | 79.5 | 47.3 | 29 | 63.8 | 37.8 | 24.2 | 31 | 6.2 | 10 | 72.6 | 61.3 | 2.53 | −0.99 | 7,448 | ne. | 32 | ne. | 11 | 4 | 4 | 10 | 17 |
| Key West | 20 | 30.00 | +.03 | 29.97 | 30.11 | 30 | 29.72 | 10 | 0.39 | 78.3 | −0.6 | 90.7 | 11 | 82.3 | 67.9 | 26 | 74.9 | 22.8 | 14.8 | 15 | 3.3 | 31 | 75.8 | 69.8 | 3.32 | −2.32 | 9,902 | ne. | 32 | se. | 10 | 10 | 9 | 14 | 8 |
| Sanford | 25 | 30.04 | ........ | 30.03 | 30.18 | 30 | 29.87 | 10 | 0.31 | 72.6 | −0.8 | 85.8 | 1 | 78.9 | 56.0 | 31 | 67.6 | 29.8 | 18.3 | 14 | 6.1 | 20 | 79.8 | 65.5 | 8.75 | +2.46 | 6,702 | n. | 32 | n. | 3 | 17 | 11 | 11 | 9 |
| *Eastern Gulf States.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Atlanta | 1,129 | 29.03 | +.09 | 30.18 | 30.41 | 20 | 29.87 | 14 | 0.54 | 62.3 | −0.8 | 83.9 | 14 | 73.2 | 34.2 | 25 | 52.1 | 49.7 | 29.0 | 31 | 9.6 | 26 | 61.1 | 47.4 | 0.03 | −2.61 | 6,552 | e. | 24 | e. | 11 | 2 | 2 | 10 | 19 |
| Pensacola | 30 | 30.10 | +.06 | 30.06 | 30.28 | 31 | 29.76 | 11 | 0.52 | 69.0 | −1.7 | 84.0 | 14 | 78.3 | 41.4 | 29 | 61.6 | 42.6 | 25.7 | 29 | 7.3 | 12 | 71.3 | 58.7 | 0.20 | −3.76 | 5,535 | e. | 27 | n. | 11 | 3 | 3 | 6 | 22 |
| Mobile | 35 | 30.11 | +.08 | 30.11 | 30.31 | 31 | 29.82 | 11 | 0.49 | 67.4 | −0.5 | 88.8 | 14 | 77.7 | 37.1 | 29 | 58.1 | 51.7 | 26.8 | 29 | 6.9 | 12 | 66.7 | 54.6 | 0.13 | −3.53 | 5,639 | n. | 24 | n. | 11 | 2 | 1 | 9 | 21 |
| Montgomery | 219 | 29.93 | +.07 | 30.13 | 30.32 | 30 | 29.89 | 14 | 0.43 | 66.0 | +0.2 | 88.1 | 14 | 77.6 | 37.1 | 28 | 56.3 | 51.0 | 28.7 | 31 | 7.6 | 26 | 65.0 | 52.4 | 0.03 | −2.55 | 3,786 | e. | 24 | e. | 11 | 1 | 3 | 6 | 21 |
| Vicksburg | 222 | 29.93 | +.08 | 30.14 | 30.36 | 31 | 29.71 | 13 | 0.65 | 65.4 | −0.7 | 85.0 | 19 | 77.4 | 36.3 | 28 | 55.7 | 48.7 | 33.1 | 3 | 9.1 | 13 | 69.9 | 54.1 | 0.64 | −3.71 | 3,740 | s. | 25 | ne. | 13 | 4 | 3 | 6 | 22 |
| New Orleans | 52 | 30.08 | +.09 | 30.10 | 30.30 | 30 | 29.79 | 11 | 0.51 | 69.5 | −0.9 | 87.4 | 14 | 77.9 | 45.3 | 28 | 63.4 | 42.1 | 20.8 | 3 | 8.4 | 26 | 71.8 | 59.0 | 0.22 | −3.15 | 6,025 | ne. | 38 | ne. | 11 | 2 | 0 | 19 | 21 |
| *Western Gulf States.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shreveport | 227 | 29.93 | +.10 | 30.13 | 30.38 | 26 | 29.57 | 13 | 0.81 | 64.7 | −1.3 | 84.4 | 9 | 76.5 | 39.4 | 28 | 55.9 | 45.0 | 30.4 | 18 | 6.7 | 13 | 77.0 | 56.2 | 3.59 | −0.13 | 3,169 | se. | 25 | e. | 13 | 4 | 0 | 12 | 19 |
| Fort Smith | 470 | 29.66 | ........ | 30.11 | 30.42 | 26 | 29.54 | 13 | [illegible] | 61.2 | −1.5 | 82.9 | 12 | 74.2 | 31.0 | 29 | 51.6 | 51.9 | 35.0 | 29 | 5.2 | 13 | 70.8 | 52.4 | 1.53 | −2.45 | 2,894 | se. | 16 | se. | 14 | 5 | 5 | 9 | 17 |
| Little Rock | [illegible] | 29.85 | +.11 | 30.13 | 30.39 | 16 | 29.60 | 13 | 0.79 | 62.0 | −2.7 | 82.3 | 24 | 73.7 | 33.1 | 28 | 52.5 | 49.2 | 33.6 | 31 | 5.7 | 13 | 73.9 | 52.2 | 1.07 | −2.03 | 2,151 | nw. | 18 | nw. | 14 | 3 | 1 | 14 | 16 |
| Galveston | 40 | 30.10 | +.10 | 30.10 | 30.33 | 26 | 29.35 | 12 | 0.98 | 71.6 | −1.0 | 83.4 | 8 | 77.2 | 50.2 | 27 | 66.4 | 33.2 | 15.5 | 27 | 7.6 | 12 | 72.9 | 62.1 | 1.93 | −3.58 | 7,144 | e. | 55 | nw. | 12 | 5 | 2 | 6 | 23 |
| Palestine | 533 | 29.62 | +.12 | 30.15 | 30.41 | 26 | 29.64 | 13 | 0.78 | 64.5 | −2.5 | 84.2 | 21 | 75.2 | 39.5 | 28 | 55.7 | 44.7 | 26.5 | 17 | 7.9 | 13 | 70.5 | 53.5 | 1.95 | −2.39 | 5,676 | ne. | 28 | nw. | 25 | 5 | 3 | 9 | 19 |
| San Antonio | 781 | 29.31 | +.09 | 30.09 | 30.40 | 26 | 29.73 | 13 | 0.67 | 68.4 | −1.6 | 90.8 | 13 | 79.7 | 43.0 | 27 | 58.3 | 47.8 | 30.5 | 18 | 11.9 | 21 | 78.5 | 60.0 | 0.62 | −1.86 | 5,596 | n. | 28 | n. | 24 | 4 | 4 | 15 | 12 |
| *Rio Grande Valley.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Brownsville | 57 | 30.05 | +.10 | 30.06 | 30.34 | 26 | 29.78 | 12 | 0.55 | 73.1 | −2.1 | 88.6 | 14 | 82.7 | 52.2 | 28 | 65.7 | 36.4 | 23.6 | 28 | 12.7 | 1 | 83.0 | 67.1 | 0.55 | −4.50 | 4,347 | n. | 20 | se. | 19 | 2 | 1 | 8 | 22 |
| Rio Grande City | 230 | 29.91 | +.08 | 30.10 | 30.41 | 26 | 29.80 | 13 | 0.61 | 73.9 | 0.0 | 94.0 | 14 | 86.2 | 47.3 | 28 | 64.5 | 46.7 | 29.8 | 17 | 11.7 | 1 | 71.1 | 62.7 | 0.13 | −2.24 | 2,418 | se. | 14 | se. | 24 | 1 | 2 | 7 | 22 |
| *Ohio Val. & Tenn.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chattanooga | 783 | 29.39 | +.10 | 30.20 | 30.42 | 20 | 29.82 | 14 | 0.60 | 59.7 | −2.9 | 84.7 | 14 | 73.4 | 36.8 | 30 | 48.6 | 47.9 | 32.7 | 5 | 12.0 | 27 | 69.6 | 48.0 | 1.28 | −2.24 | 3,370 | ne. | 22 | sw. | 14 | 3 | 3 | 10 | 18 |
| Knoxville | 980 | 29.19 | +.10 | 30.22 | 30.44 | 20 | 29.79 | 14 | 0.66 | 57.2 | −0.9 | 83.0 | 13 | 71.5 | 32.0 | 31 | 45.8 | 51.0 | 35.2 | 12 | 8.0 | 28 | 81.1 | 50.7 | 0.87 | −2.40 | 2,267 | ne. | 28 | w. | 14 | 4 | 5 | 7 | 19 |
| Memphis | 320 | 29.86 | +.12 | 30.17 | 30.40 | 16 | 29.53 | 13 | 0.87 | 62.3 | +0.5 | 85.0 | 12 | 73.8 | 34.5 | 28 | 52.8 | 50.5 | 31.6 | 31 | 9.6 | 26 | 66.6 | 49.6 | 0.59 | −2.99 | 4,010 | nw. | 30 | se. | 14 | 4 | 1 | 5 | 25 |
| Nashville | 549 | 29.61 | +.11 | 30.18 | 30.42 | 16 | 29.70 | 14 | 0.72 | 58.9 | −1.6 | 84.1 | 13 | 72.1 | 33.2 | 28 | 47.3 | 50.9 | 39.9 | 23 | 5.7 | 27 | 69.4 | 47.2 | 0.51 | −2.51 | 3,384 | e. | 28 | s. | 14 | 3 | 3 | 7 | 21 |
| Louisville | 551 | 29.62 | +.12 | 30.20 | 30.47 | 16 | 29.56 | 14 | 0.91 | 58.4 | 0.0 | 83.4 | 12 | 70.6 | 30.3 | 30 | 47.5 | 53.1 | 34.4 | 31 | 5.6 | 27 | 63.7 | 44.2 | 0.64 | −2.86 | 3,255 | n. | 38 | sw. | 14 | 5 | 4 | 8 | 19 |
| Greencastle | [illegible] | 29.24 | ........ | 30.18 | 30.49 | 16 | 29.39 | 14 | 1.11 | 56.4 | ........ | 79.3 | 13 | 65.9 | 34.6 | 1 | 48.4 | 44.7 | 25.3 | 17 | 5.7 | 27 | 70.4 | 46.1 | 0.62 | ........ | 3,527 | se. | 30 | w. | 14 | 5 | 4 | 7 | 20 |
| Indianapolis | 766 | 29.39 | +.13 | 30.20 | 30.49 | 16 | 29.39 | 14 | 1.10 | 55.3 | +0.2 | 82.3 | 13 | 67.4 | 31.7 | 2 | 44.7 | 50.6 | 36.0 | 31 | 5.0 | 27 | 66.3 | 42.5 | 1.20 | −2.17 | 3,161 | s. | 26 | w. | 14 | 4 | 4 | 7 | 20 |
| Cincinnati | 628 | 29.54 | +.12 | 30.20 | 30.48 | 16 | 29.52 | 14 | 0.96 | 56.2 | −1.3 | 83.4 | 13 | 68.1 | 32.5 | 27 | 45.7 | 50.9 | 33.0 | 13 | 6.5 | 29 | 72.1 | 46.0 | 0.82 | −2.11 | 4,275 | se. | 40 | w. | 14 | 5 | 4 | 9 | 18 |
| Columbus | 805 | 29.33 | +.09 | 30.19 | 30.48 | 16 | 29.55 | 14 | 0.93 | 54.3 | −1.5 | 80.7 | 13 | 65.8 | 32.0 | 27 | 42.9 | 48.7 | 34.3 | 17 | 7.0 | 26 | 66.5 | 41.8 | 1.13 | −2.34 | 4,047 | sw. | 45 | sw. | 14 | 5 | 6 | 9 | 16 |
| Pittsburg | 847 | 29.27 | +.06 | 30.16 | 30.43 | 3 | 29.47 | 14 | 0.90 | 55.1 | +0.9 | 79.2 | 13 | 66.6 | 35.5 | 3 | 46.1 | 43.7 | 29.5 | 19 | 5.9 | 28 | 72.2 | 45.0 | 1.00 | −1.61 | 3,832 | nw. | 30 | s. | 14 | 7 | 7 | 8 | 16 |
| *Lower lake region.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Buffalo | 690 | 29.42 | +.10 | 30.17 | 30.51 | 26 | 29.38 | 14 | 1.13 | 52.0 | +1.2 | 71.2 | 20 | 59.3 | 33.9 | 16 | 45.4 | 37.3 | 25.6 | 24 | 4.7 | 28 | 79.1 | 45.2 | 1.67 | −2.29 | 8,070 | sw. | 63 | sw. | 14 | 14 | 11 | 11 | 9 |
| Oswego | 335 | 29.78 | +.06 | 30.15 | 30.51 | 26 | 29.52 | 14 | 0.99 | 50.3 | −0.9 | 71.7 | 20 | 58.1 | 29.1 | 17 | 42.6 | 42.6 | 27.1 | 15 | 4.1 | 29 | 77.1 | 43.0 | 2.12 | −1.34 | 7,790 | s. | 35 | s. | 14 | 12 | 14 | 8 | 9 |
| Rochester | 621 | 29.49 | +.09 | 30.17 | 30.52 | 26 | 29.50 | 14 | 1.02 | 50.2 | −0.1 | 76.6 | 10 | 59.4 | 28.0 | 17 | 42.6 | 48.6 | 29.5 | 7 | 3.1 | 5 | 82.0 | 44.3 | 2.30 | −0.91 | 8,461 | sw. | 44 | s. | 14 | 16 | 13 | 10 | 8 |
| Erie | 681 | 29.44 | +.10 | 30.17 | 30.46 | 16 | 29.36 | 14 | 1.10 | 53.3 | 0.0 | 73.0 | 20 | 63.5 | 33.4 | 26 | 45.2 | 44.6 | 29.0 | 3 | 8.7 | 5 | 74.1 | 43.6 | 1.73 | −2.81 | 6,554 | s. | 36 | sw. | 14 | 14 | 10 | 11 | 10 |
| Cleveland | 690 | 29.43 | +.09 | 30.17 | 30.46 | 16 | 29.37 | 14 | 1.10 | 53.9 | +0.9 | 80.0 | 13 | 63.7 | 35.1 | 17 | 44.7 | 44.9 | 34.6 | 20 | 6.7 | 30 | 69.7 | 43.3 | 0.47 | −2.63 | 6,621 | s. | 44 | sw. | 14 | 7 | 9 | 11 | 11 |
| Sandusky | 638 | 29.51 | +.12 | 30.19 | 30.50 | 16 | 29.38 | 14 | 1.12 | 54.0 | −1.0 | 82.9 | 13 | 63.9 | 34.9 | 28 | 46.1 | 48.0 | 33.0 | 17 | 4.9 | 26 | 73.5 | 44.9 | 1.24 | −1.94 | 9,304 | w. | 53 | w. | 14 | 8 | 11 | 6 | 14 |
| Toledo | 651 | 29.49 | +.13 | 30.19 | 30.52 | 16 | 29.35 | 14 | 1.18 | 53.4 | ........ | 80.2 | 13 | 63.9 | 33.8 | 2 | 44.4 | 46.4 | 30.3 | 17 | 6.0 | 26 | 69.4 | 42.3 | 1.60 | −1.20 | 5,222 | sw. | 44 | sw. | 14 | 5 | 7 | 10 | 14 |
| Detroit | 662 | 29.46 | +.10 | 30.17 | 30.52 | 26 | 29.23 | 14 | 1.29 | 54.8 | +2.9 | 77.0 | 12 | 62.8 | 35.7 | 16 | 48.0 | 41.3 | 21.5 | 17 | 5.4 | 26 | 73.4 | 46.0 | 1.04 | −1.69 | 5,145 | sw. | 52 | w. | 14 | 7 | 8 | 8 | 15 |
| *Upper lake region.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Green Bay | 616 | 29.46 | ........ | 30.13 | 30.66 | 26 | 29.19 | 14 | 1.47 | 51.6 | ........ | 77.7 | 10 | 61.3 | 27.1 | 29 | 42.1 | 50.6 | 32.8 | 29 | 8.2 | 23 | 81.8 | 45.8 | 5.40 | ........ | 6,457 | s. | 36 | nw. | 14 | 8 | 12 | 9 | 10 |
| Alpena | 609 | 29.47 | +.10 | 30.14 | 30.64 | 26 | 29.00 | 14 | 1.65 | 48.1 | +2.9 | 78.3 | 8 | 57.9 | 29.0 | 16 | 40.5 | 49.3 | 32.2 | 3 | 6.8 | 13 | 81.2 | 41.9 | 1.80 | −2.86 | 6,325 | w. | 36 | w. | 15 | 14 | 12 | 10 | 9 |
| Escanaba | 608 | 29.45 | +.10 | 30.12 | 30.67 | 26 | 29.13 | 14 | 1.54 | 48.2 | +3.3 | 70.5 | 8 | 55.5 | 24.4 | 26 | 39.3 | 46.1 | 30.5 | 20 | 5.0 | 12 | 81.5 | 42.5 | 3.03 | −0.84 | 6,037 | sw. | 27 | n. | 24 | 8 | 8 | 11 | 12 |
| Grand Haven | 690 | 29.47 | +.10 | 30.15 | 30.60 | 26 | 29.12 | 14 | 1.48 | 52.3 | +2.0 | 73.0 | 13 | 60.2 | 28.0 | 26 | 44.0 | 45.0 | 29.5 | 19 | 6.0 | 22 | 76.7 | 44.8 | 2.50 | −0.54 | 8,412 | s. | 52 | nw. | 14 | 8 | 10 | 14 | 7 |
| Mackinaw City | 605 | 29.45 | +.06 | 30.12 | 30.64 | 26 | 28.93 | 14 | 1.71 | 50.3 | +3.2 | 70.5 | 8 | 57.7 | 28.0 | 27 | 42.7 | 48.5 | 27.9 | 19 | 5.4 | 13 | 74.5 | 41.9 | 3.13 | +0.22 | 6,478 | sw. | 35 | w. | 14 | 10 | 9 | 10 | 12 |
| Marquette | 672 | 29.36 | +.07 | 30.10 | 30.68 | 25 | 29.20 | 14 | 1.48 | 50.3 | +4.7 | 80.3 | 7 | 60.8 | 27.0 | 27 | 40.6 | 53.3 | 36.1 | 5 | 6.5 | 12 | 73.2 | 41.2 | 2.15 | −1.62 | 7,734 | w. | 34 | w. | 3 | 10 | 8 | 12 | 11 |
| Port Huron | 633 | 29.48 | +.10 | 30.16 | 30.54 | 26 | 29.19 | 14 | 1.35 | 52.3 | +2.7 | 77.8 | 12 | 61.0 | 31.4 | 2 | 43.5 | 46.4 | 30.0 | 19 | 4.1 | 28 | 79.6 | 45.6 | 1.31 | −1.86 | 6,426 | s. | 50 | sw. | 14 | 9 | 10 | 11 | 10 |
| Chicago | 661 | 29.46 | +.11 | 30.16 | 30.55 | 16 | 29.18 | 14 | 1.33 | 56.6 | +3.9 | 79.4 | 12 | 64.7 | 32.1 | 1 | 49.3 | 47.4 | 22.6 | 3 | 4.6 | 27 | 71.2 | 46.8 | 1.42 | −2.42 | 5,501 | s. | 37 | sw. | 14 | 7 | 8 | 4 | 19 |
| Milwaukee | 697 | 29.39 | +.11 | 30.14 | 30.59 | 16 | 29.17 | 14 | 1.42 | 52.7 | +4.1 | 82.3 | 12 | 63.0 | 31.3 | 2 | 44.5 | 51.0 | 29.5 | 31 | 6.8 | 18 | 69.1 | 42.1 | 2.31 | −0.46 | 7,408 | sw. | 48 | nw. | 14 | 6 | 6 | 13 | 12 |
| Duluth | 672 | 29.34 | +.06 | 30.08 | 30.69 | 25 | 29.43 | 14 | 1.25 | 46.9 | +2.1 | 80.2 | 7 | 58.2 | 27.2 | 26 | 39.3 | 53.0 | 37.1 | 19 | 5.3 | 12 | 74.3 | 38.1 | 2.45 | −0.53 | 4,156 | ne. | 30 | sw. | 20 | 11 | 5 | 13 | 13 |
| *Extreme northwest.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Moorhead | 923 | 29.01 | +.02 | 30.03 | 30.71 | 25 | 29.51 | 19 | 1.20 | 48.4 | +6.2 | 83.0 | 9 | 62.2 | 10.2 | 1 | 35.9 | 72.8 | 47.7 | 1 | 8.5 | 11 | 70.0 | 37.6 | 2.21 | −0.67 | 8,953 | s. | 44 | s. | 19 | 8 | 12 | 11 | 8 |
| Saint Vincent | 804 | 29.14 | +.01 | 30.04 | 30.72 | 25 | 29.54 | 19 | 1.18 | 45.7 | +6.0 | 81.6 | 9 | 58.1 | 14.9 | 1 | 33.5 | 66.7 | 46.3 | 4 | 6.0 | 10 | 76.1 | 37.9 | 1.36 | −1.07 | 7,366 | s. | 30 | s. | 26 | 7 | 8 | 12 | 11 |
| Bismarck | 1,694 | 28.21 | +.03 | 30.03 | 30.74 | 25 | 29.59 | 23 | 1.15 | 47.3 | +4.0 | 81.5 | 4 | 60.4 | 19.2 | 25 | 36.1 | 62.3 | 43.4 | 1 | 8.4 | 11 | 66.1 | 34.8 | 0.65 | −0.39 | 5,489 | n. | 33 | nw. | 14 | 6 | 4 | 11 | 16 |
| Fort Buford | 1,930 | 27.97 | +.01 | 29.97 | 30.58 | 24 | 29.49 | 23 | 1.09 | 44.8 | +2.6 | 85.0 | 4 | 58.2 | 22.3 | 15 | 33.2 | 62.7 | 45.3 | 4 | 6.5 | 15 | 80.4 | 38.1 | 1.57 | +0.73 | 5,383 | s. | 30 | nw. | 14 | 6 | 8 | 14 | 9 |
| Fort Totten | 1,487 | 28.40 | ........ | 30.03 | 30.73 | 25 | 29.55 | 19 | 1.18 | 46.0 | ........ | 80.5 | 4 | 57.7 | 20.3 | 25 | 35.1 | 60.2 | 42.9 | 1 | 6.0 | 11 | 66.9 | 34.8 | 1.16 | ........ | 9,639 | s. | 45 | nw. | 14 | 9 | 11 | 11 | 9 |
| Fort Yates | ........ | ........ | ........ | ........ | ........ | ... | ........ | ... | ...... | 50.0 | ........ | 85.8 | 2 | 63.7 | 17.4 | 25 | 36.2 | 68.4 | ...... | ... | ...... | ... | ...... | ........ | 0.50 | −0.21 | ........ | ........ | ... | ........ | ... | 9 | ... | ... | ... |

*Table of miscellaneous meteorological data for October, 1886—Signal Service observations*—Continued.

| Stations. | Elevation above sea-level. | Atmospheric pressure (in inches and hundredths). Mean actual barometer. | Departure from normal. | Mean reduced barometer. | Extremes. Highest barometer | Date. | Lowest barometer | Date. | Monthly range of barometer. | Temperature of the air (in degrees Fahrenheit). Monthly mean. | Departure from normal. | Extremes. Max. | Date. | Mean max | Min. | Date. | Mean min. | Monthly range. | Daily ranges. Greatest. | Date. | Least. | Date. | Mean rel. humidity. | Mean dew-point. | Precipitation. | Departure from normal. | Winds. Total movement. | Prevailing direction. | Maximum velocity. Miles p. h. | Direction. | Date. | No. of rainy days. | No. of cloudy days. | No. of fair days. | No. of clear days. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Upper Miss. Valley.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Saint Paul | 831 | 29.18 | +.07 | 30.08 | 30.66 | 25 | 29.46 | 13 | 1.20 | 52.9 | + 6.0 | 82.0 | 7 | 65.2 | 20.9 | 27 | 41.4 | 61.1 | 37.4 | 21 | 6.2 | 12 | 69.1 | 41.9 | 0.72 | — 1.42 | 4,483 | e. | 29 | s. | 19 | 4 | 7 | 11 | 13 |
| La Crosse | 725 | 29.36 | +.12 | 30.14 | 30.71 | 26 | 29.32 | 14 | 1.39 | 51.7 | + 4.7 | 81.0 | 12 | 64.5 | 26.6 | 27 | 46.0 | 54.4 | 28.8 | 29 | 5.8 | 23 | 73.3 | 45.7 | 1.71 | — 0.88 | 6,013 | s. | 27 | nw. | 14 | 6 | 4 | 13 | 14 |
| Davenport | 615 | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| Des Moines | 849 | 29.22 | +.08 | 30.12 | 30.61 | 26 | 29.43 | 13 | 1.18 | 57.3 | + 4.5 | 84.1 | 11 | 68.4 | 27.1 | 28 | 47.6 | 57.0 | 30.2 | 29 | 9.3 | 13 | 73.3 | 48.2 | 2.62 | — 2.03 | 3,804 | sw. | 22 | sw. | 19 | 7 | 4 | 14 | 13 |
| Dubuque | 665 | 29.43 | ..... | 30.14 | 30.62 | 26 | 29.17 | 14 | 1.45 | 54.8 | + 3.6 | 85.2 | 11 | 66.8 | 26.5 | 27 | 44.1 | 58.7 | 37.2 | 3 | 5.8 | 23 | 68.0 | 43.2 | 4.08 | + 0.95 | 3,287 | s. | 25 | nw. | 14 | 4 | 4 | 9 | 18 |
| Keokuk | 618 | 29.50 | +.11 | 30.15 | 30.53 | 26 | 29.32 | 14 | 1.22 | 57.6 | + 3.1 | 81.1 | 11 | 68.1 | 33.3 | 28 | 48.7 | 47.8 | 26.8 | 29 | 7.6 | 26 | 66.1 | 45.4 | 2.38 | — 1.18 | 5,595 | s. | 31 | w. | 14 | 5 | 3 | 11 | 17 |
| Cairo | 359 | 29.83 | +.12 | 30.19 | 30.46 | 16 | 29.59 | 13 | 0.87 | 59.5 | — 0.1 | 82.6 | 12 | 70.5 | 32.0 | 28 | 49.8 | 50.6 | 35.4 | 31 | 8.0 | 26 | 68.1 | 46.9 | 0.45 | — 2.83 | 4,441 | n. | 32 | sw. | 14 | 4 | 3 | 10 | 18 |
| Springfield | 644 | 29.51 | +.12 | 30.19 | 30.51 | 16 | 29.44 | 14 | 1.07 | 57.9 | + 0.9 | 82.7 | 13 | 68.5 | 34.0 | 28 | 47.9 | 48.7 | 28.7 | 31 | 8.0 | 26 | 67.2 | 46.4 | 0.80 | — 3.80 | 5,155 | s. | 34 | sw. | 14 | 6 | 4 | 7 | 20 |
| Saint Louis | 571 | 29.58 | +.11 | 30.17 | 30.49 | 16 | 29.51 | 14 | 0.98 | 61.8 | + 4.1 | 82.7 | 13 | 70.3 | 35.0 | 28 | 52.4 | 47.7 | 32.8 | 30 | 10.6 | 27 | 56.4 | 44.9 | 0.85 | — 2.22 | 6,232 | s. | 52 | sw. | 14 | 5 | 4 | 10 | 17 |
| *Missouri Valley.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lamar | 1,028 | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| Leavenworth | 842 | 29.26 | +.09 | 30.14 | 30.58 | 26 | 29.56 | 13 | 1.02 | 59.7 | + 4.2 | 86.0 | 11 | 72.7 | 26.8 | 28 | 48.9 | 59.2 | 34.7 | 2 | 7.9 | 25 | 69.0 | 48.2 | 1.80 | — 1.63 | 4,847 | s. | 28 | s. | 19 | 6 | 5 | 7 | 19 |
| Omaha | 1,113 | 28.95 | +.06 | 30.12 | 30.67 | 26 | 29.56 | 13 | 1.10 | 58.3 | + 5.7 | 85.2 | 11 | 70.0 | 15.9 | 27 | 47.4 | 69.3 | 36.7 | 27 | 12.2 | 24 | 64.9 | 45.0 | 1.33 | — 1.82 | 5,598 | s. | 30 | s. | 19 | 6 | 6 | 13 | 13 |
| Valentine | 2,604 | 27.33 | ..... | 30.03 | 30.68 | 25 | 29.53 | 10 | 1.16 | 52.0 | ..... | 81.2 | 6 | 65.8 | 23.0 | 20 | 38.2 | 58.3 | 41.1 | 4 | 9.8 | 12 | 63.5 | 37.5 | 0.27 | ..... | 9,397 | sw. | 48 | nw. | 23 | 2 | 5 | 10 | 16 |
| Huron | 1,307 | 28.64 | +.03 | 30.04 | 30.68 | 25 | 29.54 | 23 | 1.14 | 50.7 | + 4.6 | 84.7 | 6 | 66.2 | 19.5 | 26 | 37.9 | 65.2 | 48.9 | 21 | 10.3 | 22 | 67.4 | 37.9 | 1.26 | — 0.73 | 6,880 | se. | 34 | sw. | 19 | 6 | 4 | 9 | 18 |
| Yankton | 1,234 | 28.72 | +.02 | 30.04 | 30.66 | 26 | 29.58 | 23 | 1.08 | 55.3 | + 6.4 | 82.6 | 8 | 69.7 | 19.9 | 26 | 42.3 | 62.7 | 45.6 | 2 | 13.0 | 24 | 66.0 | 42.7 | 0.31 | — 1.45 | 6,414 | s. | 37 | s. | 19 | 2 | 5 | 10 | 16 |
| *Northern slope.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fort Assiniboine | 2,690 | 27.19 | +.04 | 30.04 | 30.46 | 24 | 29.65 | 28 | 0.81 | 45.9 | + 4.4 | 81.4 | 4 | 57.0 | 19.5 | 24 | 35.2 | 61.9 | 43.0 | 1 | 7.6 | 10 | 59.0 | 31.1 | 0.51 | — 0.04 | 8,194 | sw. | 48 | w. | 13 | 4 | 11 | 9 | 11 |
| Fort Benton | 2,661 | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| Fort Custer | 3,040 | 26.86 | +.04 | 30.03 | 30.57 | 24 | 29.65 | 8 | 0.91 | 46.6 | + 0.4 | 84.7 | 4 | 59.1 | 24.0 | 25 | 34.9 | 60.7 | 44.9 | 4 | 4.3 | 12 | 66.3 | 33.4 | 1.63 | + 0.75 | 4,508 | n. | 37 | n. | 23 | 9 | 7 | 14 | 10 |
| Fort Maginnis | 4,340 | 25.58 | ..... | 30.00 | 30.44 | 24 | 29.64 | 28 | 0.80 | 44.6 | + 3.5 | 79.7 | 3 | 56.8 | 23.5 | 16 | 36.5 | 56.2 | 40.4 | 1 | 7.5 | 31 | 59.5 | 29.6 | 0.19 | — 1.26 | 7,659 | nw. | 46 | nw. | 23 | 5 | 6 | 13 | 12 |
| Fort Shaw * | 3,550 | 26.38 | ..... | 30.03 | 30.45 | 24 | 29.72 | 12 | 0.74 | 46.4 | + 4.0 | 83.6 | 1 | 60.3 | 22.7 | 16 | 36.6 | 60.9 | 50.3 | 1 | 5.8 | 10 | 65.3 | 34.1 | 0.94 | — 0.08 | 2,112 | w. | 29 | w. | 7 | 10 | 10 | 6 | 11 |
| Helena | 4,069 | 25.85 | .00 | 30.03 | 30.52 | 25 | 29.69 | 8 | 0.83 | 43.3 | + 0.2 | 73.5 | 3 | 53.0 | 23.5 | 17 | 34.6 | 50.0 | 30.7 | 3 | 7.9 | 11 | 67.1 | 32.2 | 1.57 | + 0.56 | 4,984 | sw. | 28 | sw. | 23 | 10 | 9 | 14 | 8 |
| Poplar River | 2,030 | 27.87 | ..... | 30.01 | 30.61 | 25 | 29.49 | 8 | 1.12 | 44.0 | ..... | 80.5 | 4 | 60.0 | 15.8 | 17 | 29.7 | 70.7 | 50.1 | 1 | 7.0 | 11 | 75.2 | 35.8 | 0.40 | — 0.49 | 5,047 | n. | 37 | n. | 23 | 4 | 6 | 13 | 12 |
| Deadwood | 4,600 | 25.40 | +.01 | 30.06 | 30.71 | 25 | 29.65 | 22 | 1.06 | 47.7 | + 4.1 | 78.0 | 2 | 58.2 | 24.7 | 25 | 39.5 | 53.3 | 29.9 | 1 | 6.9 | 11 | 67.7 | 36.6 | 0.96 | — 0.60 | 2,627 | ne. | 21 | sw. | 13 | 7 | 4 | 8 | 19 |
| Cheyenne | 6,105 | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| North Platte | 2,841 | 27.12 | +.02 | 30.05 | 30.65 | 25 | 29.59 | 19 | 1.06 | 54.2 | + 4.7 | 77.3 | 8 | 66.7 | 25.6 | 26 | 43.4 | 51.7 | 38.6 | 1 | 9.7 | 9 | 67.6 | 42.3 | 0.59 | — 0.73 | 6,662 | s. | 60 | s. | 18 | 3 | 1 | 13 | 17 |
| Fort Laramie | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 49.9 | ..... | 81.5 | 2 | 66.8 | 22.3 | 27 | 32.9 | 59.2 | ..... | ... | ..... | ... | ..... | ..... | 0.35 | ..... | ..... | ... | 7 | ... | ... | ... | ... | ... | ... |
| *Middle slope.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Denver | 5,294 | 24.76 | —.61 | 29.97 | 30.56 | 25 | 29.35 | 18 | 1.20 | 52.5 | + 2.3 | 77.0 | 1 | 66.8 | 22.6 | 26 | 37.0 | 54.4 | 42.0 | 1 | 11.3 | 12 | 50.1 | 31.9 | 0.33 | — 0.41 | 5,182 | s. | 32 | s. | 21 | 4 | 2 | 13 | 16 |
| Pike's Peak | 14,134 | 17.85 | ..... | 30.09 | 30.60 | 25 | 29.52 | 19 | 1.08 | 22.1 | + 0.8 | 57.3 | 1 | 28.9 | 3.6 | 13 | 17.0 | 53.7 | 30.8 | 1 | 6.0 | 28 | 78.2 | 16.0 | 1.31 | — 0.18 | 15,401 | sw. | 76 | sw. | 19 | 8 | 1 | 13 | 17 |
| Las Animas | 3,899 | 26.08 | +.03 | 29.98 | 30.60 | 26 | 29.52 | 19 | 1.08 | 55.2 | + 3.4 | 88.8 | 10 | 74.0 | 24.3 | 26 | 38.9 | 64.5 | 50.3 | 10 | 9.1 | 25 | 63.4 | 41.4 | 0.20 | — 0.44 | 4,450 | w. | 28 | sw. | 18 | 3 | 1 | 14 | 16 |
| Concordia | 1,384 | 28.63 | ..... | 30.08 | 30.65 | 26 | 29.51 | 13 | 1.14 | 59.7 | ..... | 86.9 | 10 | 72.8 | 25.4 | 27 | 47.2 | 61.5 | 39.7 | 5 | 9.5 | 25 | 63.0 | 46.3 | 1.25 | ..... | 6,392 | s. | 36 | s. | 19 | 3 | 3 | 14 | 14 |
| Dodge City | 2,523 | 27.47 | +.04 | 30.08 | 30.64 | 26 | 29.60 | 13 | 1.04 | 58.8 | + 3.9 | 86.4 | 11 | 71.5 | 28 | 26 | 48.2 | 58.1 | 35.4 | 2 | 6.3 | 21 | 68.5 | 46.7 | 0.45 | — 0.87 | 7,506 | se. | 33 | se. | 18 | 5 | 4 | 16 | 17 |
| Fort Reno | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 63.1 | ..... | 86.2 | 11 | 75.7 | 28.0 | 27 | 50.5 | 58.2 | ..... | ... | ..... | ... | ..... | ..... | 3.54 | + 0.40 | ..... | ..... | ... | ... | ... | 7 | ... | ... | ... |
| Fort Supply | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 64.5 | ..... | 84.3 | 17 | 76.6 | 31.2 | 27 | 52.4 | 53.1 | ..... | ... | ..... | ... | ..... | ..... | 1.54 | + 0.07 | ..... | ..... | ... | ... | ... | 4 | ... | ... | ... |
| Fort Elliott† | 2,700 | 27.33 | +.01 | 30.02 | 30.54 | 25 | 29.53 | 13 | 1.02 | 58.8 | ..... | 82.9 | 10 | 70.8 | 33.2 | 27 | 49.5 | 49.7 | 31.0 | 6 | 8.3 | 21 | 72.8 | 48.6 | 5.04 | ..... | 8,085 | se. | 36 | se. | 18 | 6 | 4 | 12 | 13 |
| *Southern slope.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fort Sill | 1,200 | 28.90 | +.09 | 30.13 | 30.58 | 26 | 29.64 | 13 | 0.95 | 62.6 | + 0.5 | 83.0 | 10 | 74.4 | 35.2 | 27 | 52.2 | 47.8 | 31.6 | 6 | 9.6 | 21 | 71.4 | 51.6 | 7.10 | + 4.73 | 6,951 | s. | 30 | s. | 19 | 7 | 4 | 7 | 20 |
| Abilene | 1,745 | 28.32 | ..... | 30.10 | 30.56 | 26 | 29.72 | 13 | 0.84 | 64.9 | ..... | 85.9 | 13 | 75.7 | 41.3 | 27 | 55.9 | 44.6 | 28.6 | 14 | 10.7 | 20 | 67.1 | 52.3 | 2.24 | ..... | 8,076 | s. | 36 | sw. | 19 | 3 | 2 | 9 | 20 |
| Fort Davis | 4,928 | 25.26 | +.08 | 30.02 | 30.45 | 26 | 29.76 | 7 | 0.69 | 63.3 | + 2.4 | 83.2 | 12 | 77.1 | 43.0 | 26 | 52.0 | 40.2 | 34.8 | 14 | 17.5 | 4 | 55.7 | 44.7 | 0.71 | — 1.43 | 4,323 | sw. | 20 | sw. | 7 | 2 | 2 | 6 | 23 |
| Fort Stanton | 6,150 | 24.05 | ..... | 29.96 | 30.37 | 25 | 29.65 | 18 | 0.72 | 49.6 | ..... | 74.5 | 16 | 65.7 | 26.5 | 15 | 37.2 | 48.0 | 42.5 | 15 | 14.9 | 13 | 68.0 | 38.1 | 1.32 | ..... | 4,209 | nw. | 35 | nw. | 13 | 6 | 3 | 5 | 23 |
| *Southern plateau.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| El Paso | 3,764 | 26.32 | +.05 | 30.01 | 30.39 | 26 | 29.74 | 18 | 0.64 | 62.8 | — 0.8 | 84.0 | 18 | 77.4 | 41.2 | 24 | 50.0 | 42.8 | 36.9 | 15 | 12.6 | 4 | 66.3 | 50.3 | 0.80 | — 0.64 | 2,736 | w. | 20 | w. | 13 | 3 | 1 | 8 | 22 |
| Lava | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| Santa Fé | 7,026 | 23.35 | +.05 | 30.06 | 30.51 | 26 | 29.68 | 18 | 0.83 | 49.6 | + 0.1 | 69.0 | 10 | 61.1 | 30.0 | 13 | 40.2 | 39.0 | 28.0 | 14 | 9.7 | 4 | 52.9 | 31.0 | 1.06 | + 0.04 | 4,861 | e. | 24 | n. | 13 | 4 | 1 | 8 | 22 |
| Fort Apache | 5,050 | 25.08 | +.06 | 30.05 | 30.34 | 26 | 29.73 | 18 | 0.61 | 54.0 | + 0.4 | 79.7 | 1 | 70.5 | 27.8 | 20 | 38.7 | 51.9 | 44.0 | 14 | 14.7 | 11 | 53.9 | 35.4 | 1.66 | — 0.01 | 5,164 | e. | 28 | sw. | 11 | 5 | 1 | 10 | 20 |
| Fort Bowie | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 58.8 | ..... | 78.0 | 1 | 72.4 | 41.0 | 21 | 45.3 | 37.0 | ..... | ... | ..... | ... | ..... | ..... | 0.36 | ..... | ..... | ... | 3 | ... | ... | ... | ... | ... | ... |
| Fort Grant | 4,856 | 25.27 | ..... | 30.02 | 30.24 | 26 | 29.78 | 18 | 0.46 | 61.2 | — 0.9 | 79.8 | 1 | 72.9 | 39.1 | 13 | 51.9 | 40.7 | 30.2 | 27 | 14.7 | 11 | 41.0 | 35.0 | 0.57 | — 0.36 | 5,462 | e. | 36 | e. | 26 | 3 | 1 | 6 | 24 |
| Fort McDowell | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 66.8 | ..... | 97.0 | 1 | 84.5 | 37.8 | 20 | 49.0 | 59.2 | ..... | ... | ..... | ... | ..... | ..... | 0.27 | ..... | ..... | ... | 3 | ... | ... | ... | ... | ... | ... |
| Fort Thomas | 2,710 | 27.25 | ..... | 29.96 | 30.20 | 26 | 29.67 | 18 | 0.53 | 61.4 | + 1.5 | 88.3 | 1 | 78.5 | 34.5 | 4 | 47.3 | 53.8 | 43.2 | 24 | 12.8 | 21 | 69.6 | 50.0 | 1.12 | + 0.82 | 2,489 | s. | 21 | e. | 18 | 4 | 1 | 6 | 24 |
| Fort Verde | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 60.9 | ..... | 89.3 | 1 | 77.2 | 33.0 | 13 | 44.5 | 56.3 | ..... | ... | ..... | ... | ..... | ..... | 0.13 | — 0.43 | ..... | ..... | 4 | ... | ... | ... | ... | ... | ... |
| Maricopa | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 74.0 | ..... | 99.2 | 2 | 84.3 | 40.2 | 20 | 53.7 | 59.0 | ..... | ... | ..... | ... | ..... | ..... | 0.76 | ..... | ..... | ... | 2 | ... | ... | ... | ... | ... | ... |
| Phœnix | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| Prescott | 5,389 | 24.76 | +.04 | 30.01 | 30.31 | 26 | 29.66 | 18 | 0.65 | 51.2 | — 1.3 | 77.2 | 1 | 67.3 | 26.1 | 12 | 37.9 | 51.1 | 42.8 | 24 | 12.0 | 10 | 55.6 | 33.8 | 0.23 | — 0.35 | 4,951 | sw. | 36 | sw. | 18 | 7 | 1 | 8 | 22 |
| San Carlos | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 62.1 | ..... | 92.0 | 1 | 80.1 | 35.3 | 24 | 44.1 | 56.7 | ..... | ... | ..... | ... | ..... | ..... | 0.46 | — 0.32 | ..... | ..... | ... | ... | ... | ... | ... | ... | ... |
| Willcox | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 60.4 | ..... | 92.0 | 10 | 82.3 | 25.0 | 23 | 38.4 | 67.0 | ..... | ... | ..... | ... | ..... | ..... | 0.36 | ..... | ..... | ... | 3 | ... | ... | ... | ... | ... | ... |
| Yuma | 141 | 29.81 | +.07 | 29.93 | 30.14 | 22 | 29.73 | 9 | 0.40 | 67.4 | — 4.9 | 92.6 | 1 | 81.3 | 46.7 | 23 | 55.2 | 45.9 | 34.9 | 27 | 14.2 | 10 | 52.6 | 47.0 | 1.11 | + 1.07 | 3,707 | ne. | 30 | e. | 3 | 2 | 0 | 4 | 27 |
| *Middle plateau.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fort Bidwell | 4,615 | 25.42 | ..... | 30.10 | 30.38 | 25 | 29.84 | 29 | 0.54 | 44.6 | ..... | 78.8 | 3 | 56.5 | 21.8 | 31 | 32.8 | 57.0 | 37.4 | 3 | 10.6 | 11 | 65.1 | 32.4 | 1.36 | ..... | 3,101 | w. | 28 | sw. | 27 | 9 | 7 | 13 | 11 |
| Winnemucca | 4,358 | 25.64 | +.01 | 30.05 | 30.37 | 25 | 29.74 | 9 | 0.63 | 44.2 | — 3.1 | 76.7 | 4 | 58.6 | 16.7 | 9 | 32.3 | 60.0 | 48.5 | 7 | 10.3 | 11 | 58.5 | 28.1 | 1.72 | + 1.17 | 4,750 | sw. | 34 | sw. | 8 | 9 | 4 | 17 | 10 |
| Frisco | 6,406 | 23.72 | ..... | 29.91 | 30.29 | 25 | 29.46 | 9 | 0.82 | 47.1 | ..... | 67.4 | 4 | 56.2 | 25.8 | 19 | 39.0 | 41.6 | 24.4 | 18 | 10.8 | 6 | 52.3 | 29.2 | 0.66 | ..... | 9,433 | sw. | 50 | sw. | 9 | 3 | 2 | 6 | 23 |
| Salt Lake City | 4,348 | 25.65 | —.02 | 30.00 | 30.44 | 25 | 29.49 | 9 | 0.95 | 51.8 | — 0.3 | 77.3 | 1 | 62.4 | 28.6 | 20 | 41.1 | 48.7 | 33.4 | 29 | 8.1 | 22 | 62.7 | 37.8 | 1.98 | + 0.27 | 4,193 | se. | 28 | s. | 16 | 8 | 4 | 11 | 16 |
| Montrose | 5,780 | 24.34 | ..... | 30.00 | 30.44 | 26 | 29.50 | 18 | 0.93 | 48.5 | ..... | 76.0 | 1 | 63.6 | 25.2 | 20 | 36.3 | 50.8 | 38.4 | 15 | 13.7 | 6 | 58.0 | 32.2 | 0.95 | ..... | 4,468 | se. | 34 | s. | 18 | 7 | 2 | 15 | 14 |
| Fort Bridger | 6,643 | 23.53 | ..... | 30.06 | 30.57 | 25 | 29.57 | 10 | 0.70 | 39.6 | ..... | 68.8 | 1 | 53.3 | 10.1 | 30 | 27.6 | 58.7 | 40.1 | 8 | 10.0 | 19 | 72.3 | 30.0 | 0.93 | ..... | 5,184 | sw. | 33 | n. | 1 | 10 | 3 | 18 | 10 |
| *Northern plateau.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Boisé City | 2,750 | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| Cœur d'Alene | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 47.2 | ..... | 79.0 | 4 | 58.7 | 28.0 | 10 | 35.8 | 51.0 | ..... | ... | ..... | ... | ..... | ..... | 2.57 | + 0.66 | ..... | ..... | ... | ... | ... | 13 | ... | ... | ... |
| Ashland | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 50.7 | ..... | 83.0 | 3 | 63.1 | 28.0 | 30 | 28.0 | 55.0 | ..... | ... | ..... | ... | ..... | ..... | 1.65 | ..... | ..... | ... | ... | ... | ... | 11 | ... | ... | ... |
| Fort Klamath | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 39.9 | ..... | 74.0 | 3 | 54.8 | 11.0 | 31 | 28.1 | 63.0 | ..... | ... | ..... | ... | ..... | ..... | 1.54 | ..... | ..... | ... | ... | ... | ... | 9 | ... | ... | ... |
| Lakeview | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 44.4 | ..... | 75.0 | 3 | 55.0 | 20.5 | 12 | 33.8 | 54.5 | 35.2 | 12 | 5.5 | 28 | ..... | ..... | 1.51 | ..... | ..... | ... | ... | ... | ... | 12 | ... | ... | ... |
| Linkville | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 46.9 | ..... | 77.1 | 3 | 58.5 | 25.9 | 30 | 35.3 | 51.2 | ..... | ... | ..... | ... | ..... | ..... | 1.53 | ..... | ..... | ... | ... | ... | ... | 8 | ... | ... | ... |
| Fort Spokane | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| Spokane Falls | 1,909 | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| *N. Pac. coast region.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fort Canby | 179 | 29.83 | +.02 | 30.03 | 30.28 | 31 | 29.61 | 14 | 0.67 | 52.4 | ..... | 62.4 | 4 | 57.4 | 40.2 | 31 | 48.1 | 22.2 | 14.4 | 26 | 6.2 | 15 | 87.6 | 48.6 | 5.24 | ..... | 6,721 | s. | 50 | s. | 27 | 15 | 9 | 11 | 11 |
| Neah Bay | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| Olympia | 36 | 30.04 | +.05 | 30.08 | 30.36 | 31 | 29.71 | 15 | 0.64 | 48.6 | — 0.4 | 66.2 | 2 | 56.5 | 34.0 | 12 | 41.7 | 32.2 | 27.3 | 25 | 4.6 | 17 | 90.4 | 45.7 | 4.15 | — 1.00 | 2,132 | s. | 20 | w. | 27 | 15 | 13 | 11 | 7 |
| Port Angeles | 14 | 30.04 | ..... | 30.06 | 30.32 | 20 | 29.70 | 27 | 0.62 | 45.0 | ..... | 58.7 | 3 | 52.6 | 29.3 | 31 | 37.8 | 29.4 | 23.1 | 11 | 4.7 | 1 | 92.7 | 42.9 | 1.88 | ..... | 2,475 | s. | 15 | w. | 27 | 13 | 10 | 15 | 6 |
| Pysht | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 40.4 | ..... | 68.0 | 7 | 52.9 | 31.0 | 31 | 39.9 | 37.0 | ..... | ... | ..... | ... | ..... | ..... | 4.85 | ..... | ..... | ... | ... | ... | ... | 12 | ... | ... | ... |
| Tatoosh Island | 86 | 29.93 | +.03 | 30.03 | 30.30 | 20 | 29.65 | 15 | 0.66 | 50.2 | ..... | 60.5 | 3 | 54.2 | 40.7 | 29 | 46.8 | 19.8 | 12.1 | 25 | 4.5 | 18 | 87.5 | 46.5 | 7.81 | ..... | 7,630 | e. | 39 | se. | 6 | 17 | 10 | 12 | 9 |
| Astoria | ..... | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | 51.7 | ..... | 67.0 | 1 | 57.4 | 40.0 | 11 | 46.0 | 27.0 | ..... | ... | ..... | ... | ..... | ..... | 5.57 | ..... | ..... | ... | ... | ... | ... | 21 | ... | ... | ... |
| Portland | 80 | 29.99 | +.03 | 30.08 | 30.36 | 31 | 29.72 | 14 | 0.64 | 51.4 | — 1.6 | 76.0 | 3 | 60.2 | 33.9 | 12 | 44.4 | 42.1 | 33.0 | 3 | 7.6 | 14 | 82.5 | 45.7 | 2.87 | — 1.78 | 3,097 | s. | 21 | s. | 15 | 14 | 9 | 13 | 9 |
| Roseburg | 523 | 29.55 | +.04 | 30.11 | 30.39 | 31 | 29.75 | 14 | 0.64 | 50.7 | — 0.5 | 82.0 | 3 | 61.9 | 32.7 | 12 | 42.9 | 49.3 | 40.4 | 3 | 7.8 | 23 | 82.6 | 45.0 | 3.43 | — 0.66 | 1,677 | ne. | 16 | sw. | 27 | 19 | 11 | 13 | 7 |
| Walla Walla | 1,018 | 29.00 | ..... | 30.10 | 30.42 | 24 | 29.84 | 14 | 0.58 | 50.2 | ..... | 77.9 | 3 | 60.7 | 33.4 | 25 | 43.0 | 44.5 | 28.7 | 3 | 8.8 | 18 | 68.3 | 39.0 | 1.95 | ..... | 3,805 | sw. | 26 | sw. | 13 | 16 | 5 | 15 | 11 |
| Sitka | 63 | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| *Mid. Pac. coast reg.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cape Mendocino | 637 | ..... | ..... | ..... | ..... | ... | ..... | ... | ... | ..... | ..... | ..... | ... | ..... | ..... | ... | ..... | ... | ..... | ... | ..... | ... | ..... | ..... | ..... | ..... | ..... | ... | ... | ... | ... | ... | ... | ... | ... |
| Red Bluff | 332 | 29.68 | +.02 | 30.02 | 30.25 | 22 | 29.76 | 29 | 0.49 | 60.7 | — 2.2 | 92.6 | 3 | 72.1 | 38.5 | 31 | 49.1 | 54.1 | 37.5 | 2 | 13.2 | 30 | 53.0 | 40.8 | 1.76 | + 0.48 | 3,038 | n. | 18 | n: | 9 | 8 | 7 | 7 | 17 |
| Sacramento | 64 | 29.97 | +.04 | 30.02 | 30.28 | 31 | 29.80 | 20 | 0.48 | 57.1 | — 3.7 | 85.5 | 2 | 70.9 | 38.5 | 21 | 46.7 | 47.0 | 36.0 | 2 | 4.8 | 30 | 69.7 | 46.2 | 0.68 | — 0.25 | 3,583 | nw. | 17 | nw. | 20 | 3 | 0 | 9 | 22 |
| San Francisco | 60 | 30.01 | +.05 | 30.05 | 30.29 | 31 | 29.84 | 28 | 0.45 | 57.1 | — 2.1 | 78.9 | 3 | 66.1 | 46.0 | 13 | 51.1 | 32.9 | 28.9 | 3 | 6.3 | 9 | 76.7 | 49.1 | 1.48 | + 0.28 | 5,449 | w. | 28 | w. | 3 | 5 | 4 | 11 | 16 |
| Keeler | 3,622 | 26.32 | ..... | 29.92 | 30.23 | 25 | 29.50 | 9 | 0.73 | 58.2 | ..... | 81.4 | 4 | 68.6 | 33.6 | 31 | 46.8 | 47.8 | 27.6 | 7 | 15.3 | 20 | 29.6 | 24.6 | 0.01 | ..... | 5,512 | sw. | 40 | sw. | 9 | 1 | 1 | 6 | 24 |
| *S. Pac. coast region.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Los Angeles | 339 | 29.68 | +.08 | 30.01 | 30.23 | 21 | 29.89 | 9 | 0.35 | 59.3 | — 3.5 | 82.2 | 25 | 71.9 | 41.1 | 27 | 48.3 | 41.1 | 39.4 | 25 | 8.2 | 29 | 80.0 | 52.4 | 0.02 | — 0.54 | 4,076 | w. | 24 | w. | 18 | 1 | 2 | 14 | 15 |
| San Diego | 67 | 29.97 | +.08 | 30.01 | 30.24 | 21 | 29.90 | 28 | 0.34 | 59.7 | — 3.1 | 75.0 | 13 | 66.6 | 46.6 | 23 | 53.3 | 28.4 | 26.5 | 13 | 6.5 | 9 | 81.8 | 53.8 | 0.05 | — 0.42 | 4,047 | nw. | 19 | nw. | 25 | 1 | 4 | 16 | 11 |

* Record for 27 days.

† Record for 28 days.

*Temperature and rainfall data for the cotton districts, October.*

| Districts. | Rainfall. | | | Temperature. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Maximum. | | | Minimum. | | | Extremes for Oct., 1886. | |
| | Average for October of four preceding years. | Average for October, 1886. | Departures. | Mean for Oct. of four preceding years. | Mean for Oct. 1886. | Departures. | Mean for Oct. of four preceding years. | Mean for Oct., 1886. | Departures. | Max. | Min. |
| | Inch. | Inch. | Inch. | ° | ° | ° | ° | ° | ° | ° | ° |
| New Orleans | 2.35 | 1.40 | — 0.95 | 80.7 | 77.4 | — 3.3 | 59.3 | 55.0 | — 4.3 | 88 | 30 |
| Savannah | 3.35 | 1.04 | — 1.31 | 80.7 | 78.8 | — 1.9 | 59.5 | 56.6 | — 2.9 | 92 | 31 |
| Charleston | 3.03 | 0.88 | — 1.94 | 77.3 | 76.5 | — 0.8 | 54.9 | 52.0 | — 2.9 | 88 | 31 |
| Atlanta | 3.66 | 0.89 | — 2.57 | 75.3 | 75.4 | + 0.1 | 54.2 | 49.7 | — 4.5 | 88 | 23 |
| Wilmington * | 3.01 | 0.79 | — 1.31 | 76.9 | 74.6 | — 2.3 | 54.6 | 49.7 | — 4.9 | 89 | 30 |
| Memphis | 3.65 | 0.66 | — 1.99 | 75.4 | 74.8 | — 0.6 | 52.4 | 48.1 | — 4.3 | 88 | 24 |
| Galveston * | 3.31 | 1.41 | — 1.90 | 81.1 | 79.0 | — 2.1 | 59.4 | 57.3 | — 2.1 | 91 | 34 |
| Vicksburg | 2.99 | 0.90 | — 2.09 | 76.6 | 76.8 | — 1.8 | 55.9 | 54.2 | — 1.7 | 85 | 31 |
| Montgomery | 1.60 | 0.13 | — 1.47 | 79.2 | 78.5 | — 0.7 | 59.9 | 55.9 | — 4.0 | 90 | 33 |
| Augusta | 2.36 | 0.25 | — 2.11 | 77.1 | 75.5 | — 1.6 | 54.8 | 50.0 | — 4.8 | 88 | 30 |
| Little Rock | 2.93 | 1.11 | — 0.92 | 76.1 | 75.5 | — 0.6 | 50.8 | 50.3 | — 0.5 | 93 | 22 |
| Mobile | 2.13 | 0.27 | — 1.86 | 79.7 | 78.1 | — 1.6 | 56.3 | 51.3 | — 5.0 | 89 | 28 |

* Averages for three years only.

## ATMOSPHERIC ELECTRICITY.

### AURORAS.

Mount Washington, New Hampshire: a faint auroral light became visible at 9.20 p. m. of the 5th, it gradually increased in brilliancy and extent. At 9.50 p. m. a well-defined arch was formed from which slender streamers rose to an altitude of 50° above the horizon. The dark segment upon which the arch usually rests was replaced by a slightly luminous atmosphere. The aurora was most brilliant at 10.10 p. m. At 9.40 p. m. of the 6th an aurora was observed which had attained considerable brilliancy; an arch of about four degrees width, and extending ten degrees east and west of the magnetic meridian, rested upon a dark segment. Slender luminous beams rose from the arch at intervals, those west of north being the most brilliant and of greatest duration. The maximum brilliancy occurred at 10.45 p. m., after which it faded gradually and disappeared in the early morning of the 7th. An auroral light was also visible on the 7th from 9.30 to 11.15 p. m.; it was without arch, streamers, or other distinctive features.

Eastport, Maine: an auroral arch was observed at 10 p. m. of the 5th, altitude 15°; the light disappeared at 1.50 a. m. of the 6th. Auroras were also visible on the 7th, 8th, 18th, 26th, and 27th. The aurora of the 8th was visible from 7.15 to 9 p. m. in the form of an arch from which beams of white light shot upward, appearing and disappearing very rapidly.

Fort Totten, Dakota: a brilliant auroral display occurred between 10.30 and 11 p. m. of the 7th with streamers extending upward to the altitude of 45°; azimuth of aurora 90°. Waves of light, red at their bases and green at the upper extremities, moved with great speed along the arch. Auroral lights were also seen on the 21st, 27th, 28th, 29th, 30th.

Duluth, Minnesota: an aurora was visible at 12.45 a. m. of the 8th; the display was characterized by constantly shifting vertical bands of pale yellow light in the northwest and broad horizontal waves of the same color in the north. It was only faintly visible at 1.15 a. m. and had disappeared at 1.35 a. m. An aurora was also seen on the 22d in the form of a broad belt of light stretching along the northern horizon, with waving streamers flashing upward from the lower portion of the belt to an altitude of 15°. The display disappeared at 2 a. m.

Fort Buford, Dakota: a fine auroral display began at 9.45 p. m. of the 7th and continued throughout the night. It at first presented the appearance of a number of white and rose colored curtains moving rapidly across the sky from the northwestern to the northeastern horizon and extending to a height of 45°. At 10.15 p. m. long streamers began shooting upward from the dark portions of the sky. A faint auroral light was visible during the night of the 8-9th.

Poplar River, Montana: an aurora was seen at 8.10 p. m. of the 7th. It appeared in the form of slender luminous beams of pale yellow light rising to an altitude of 40°. The aurora changed its form several times during the night and disappeared at dawn of the 8th.

Fort Custer, Montana: a faint aurora consisting of a few pale streamers was visible from 10.25 to 10.50 p. m. of the 7th. It extended from azimuth 150° to 210° and altitude 23°.

Bismarck, Dakota: an auroral light, extending from azimuth 140° to 225° and to an altitude of 40°, was visible from midnight to 4.40 a. m. of the 8th. On the 28th, at 9.30 p. m., an aurora, consisting of streamers of white light, extending from azimuth 150° to 230°, and to an altitude of 30°, was observed; it disappeared at 12.20 a. m. of the 29th.

Saint Vincent, Minnesota: at 12.20 a. m. of the 21st a faint white auroral light was visible in the north. It rapidly increased in brilliancy and, at 1.15 a. m., numerous beams were constantly falling and rising, while the "merry dancers" incessantly played backward and forward. The display ended at 2 a. m. An aurora was seen at 11.45 p. m. of the 27th; no streamers or "merry dancers" were seen, but a varying degree of brightness was a very noticeable feature, the light at times being strong and brilliant and again dull and faint. No change in the outline or position of the aurora occurred. The display continued until the early morning of the 28th; altitude, 30°; azimuth, 60°. An aurora also became visible on the 28th at 9.15 p. m., rising up in the north in the form of a pale white light. At a later hour the display became more brilliant and at midnight numerous streamers shot up to the zenith.

Moorhead, Minnesota: an aurora was observed at 9.35 p. m. of the 28th, consisting of two arches of white light, tinged with green. The arches were five degrees apart and at the highest point 45° above the northern horizon.

Mackinaw City, Michigan: at 8.10 p. m. of the 28th an aurora was observed, azimuth, 50°; altitude, 20°. At 9.30 p. m. the light began to increase in altitude, forming an arch, with bright streamers shooting up to an altitude of 40°. From 10.12 to 10.35 p. m. the display appeared in the form of two parallel arches, shortly afterwards it began to fade and had disappeared at 11.30 p. m.

Auroral displays were also observed during the month, as follows:

1st.—Milton and Blue Hill Observatory, Massachusetts; Cornish, Kent's Hill, and Orono, Maine; Mackinaw City, Michigan; Moorhead, Minnesota; Poplar River, Montana.

2d.—Kent's Hill, Maine; Poplar River, Montana.

4th.—Pekin, Illinois; Des Moines, Iowa.

5th.—Gardiner, Maine; Burlington, Vermont.

6th.—Blue Hill Observatory and Milton, Massachusetts; Cornish, Maine; Berlin Mills, New Hampshire; Newport and Burlington, Vermont.

7th.—Cresco, Iowa; Gardiner, Maine; Marquette and Mackinaw City, Michigan; Nashua, New Hampshire.

8th.—North Colebrook, Connecticut; Cottage City and Cambridge, Massachusetts; Cornish, Maine; Berlin Mills and Nashua, New Hampshire; Oswego, New York; Walla Walla, Washington Territory.

9th.—Marquette, Michigan; Moorhead, Minnesota.

10th.—Pekin, Illinois.

12th.—Pekin, Illinois; Portland, Maine.

16th.—Pekin, Illinois.

17th.—Richmond, Kentucky.

18th.—Cornish, Gardiner, and Orono, Maine; Marquette, Michigan; Newport and Post Mills, Vermont.

21st.—Marquette, Michigan.

22d.—Nashua, New Hampshire.

24th.—Poplar River, Montana.

25th.—Gardiner, Maine.

26th.—Mackinaw City and Escanaba, Michigan; Poplar River, Montana.

27th.—Henry, Dakota; Mackinaw City, Escanaba, and Traverse City, Michigan; Poplar River, Montana; Delavan and Madison, Wisconsin.

28th.—Yankton, Dakota; Riley, Illinois; Bancroft, Cresco, Independence, and West Union, Iowa; Gardiner, Kent's Hill,

and Orono, Maine; Traverse City, Marquette, and Escanaba, Michigan; Duluth, Minnesota; Poplar River, Montana; Newport, Vermont; Delavan, Embarras, Lancaster, Wausau, and Prairie du Chien, Wisconsin.

29th.—Marquette and Escanaba, Michigan; Poplar River, Montana.

30th.—Escanaba, Michigan; Monticello, Iowa.

31st.—Dale Enterprise, Wisconsin.

### CHART OF ELECTROMETER READINGS.

[Prepared under the direction of Prof. T. C. MENDENHALL, Assistant.]

Observations have been made during the month of October, 1886, at the six stations having the necessary apparatus. At Washington City several sets of simultaneous observations have been made at the Signal Office and at the top of the Washington Monument. The curves obtained on October 4th, a clear, pleasant day, with a light, dry fog in the morning, may be taken as illustrative of the difference in values obtained, under such conditions of weather, at the two places. At the Monument, feeble sparks could be obtained, on connecting the ground with the needle, when the deflection indicated over 700 volts. The observations in this, as in all the other series of simultaneous observations at these places, are taken at intervals of five minutes, except between 1 and 2 o'clock, when they are taken at minute intervals. October 5th was likewise a clear day, with light northeasterly winds. The values at both stations were approximately but half of those obtained on the preceding day. A feeble spark could be obtained when the potential indicated exceeded 455 volts. October 7th was also a day like the others. The values are much higher than those obtained on the 5th, but somewhat less than those of the 4th. The potential at the Monument averages for these dates 300 volts higher than the lower station. This value is less than that usually given. The following abridged table will serve to show, roughly, the differences on the three dates, as well as the correspondence between the two stations:

| Time. | October 4. | | October 5. | | October 7. | |
|---|---|---|---|---|---|---|
| | Monument. | Signal Office. | Monument. | Signal Office. | Monument. | Signal Office. |
| | *Volts.* | *Volts.* | *Volts.* | *Volts.* | *Volts.* | *Volts.* |
| 9 a. m. | ..... | +186 | ..... | +102 | ..... | +132 |
| 11 a. m. | ..... | 228 | ..... | 126 | ..... | 138 |
| 11.30 a. m. | ..... | 96 | ..... | 108 | ..... | 114 |
| 11.50 a. m. | +595 | 198 | +280 | 114 | +368 | 120 |
| 12 m. | 805 | 168 | 455 | 36 | 385 | 120 |
| 12.05 p. m. | 700 | 150 | 420 | 102 | 385 | 126 |
| 12 10 p. m. | 700 | 162 | 420 | 90 | 438 | 114 / 126 |
| 12.15 p. m. | 560 | 216 | 420 | 102 | 455 | 114 / 126 |
| 12.20 p. m. | 648 | 180 | 420 | 102 / 114 | 385 | 84 |
| 12.25 p. m. | 560 | 204 | 455 | 108 / 120 | 455 | 84 / 90 |
| 12.30 p. m. | 525 | 192 | 525 | 72 / 84 | 455 | 84 / 96 |
| 12.35 p. m. | 525 | 246 | 455 | 30 / 60 | 420 | 102 |
| 12.40 p. m. | 560 | 252 | 420 | 114 | 455 | 96 |
| 12.45 p. m. | 420 | 234 | 350 | 114 | 455 | 102 |
| 12.50 p. m. | 735 | 222 | 297 | 108 | 350 / 455 | 108 |
| 12.55 p. m. | 700 | 198 | 280 | 126 | 455 | 114 |
| 1 p. m. | 543 | 174 | ..... | 102 | 490 | 102 |
| 1.01 p. m. | 543 | 120 / 180 | ..... | 108 | 490 | 114 |
| 1.02 p. m. | 508 | 174 | ..... | 102 | 490 | 120 |
| 1.03 p. m. | 508 | 198 | ..... | 102 | 490 | 108 |
| 1.04 p. m. | 490 | 180 / 210 | ..... | 60 / 108 | 490 | 114 |
| 1.05 p. m. | 490 | 204 | 385 | 102 | 508 | 102 |
| 1.06 p. m. | 508 | 198 | 385 | 120 | 490 | 114 |
| 1.07 p. m. | 490 | 192 | 350 | 108 | 455 | 84 / 114 |
| 1.08 p. m. | 525 | 180 | 260 | 114 | 455 | 90 / 120 |
| 1.09 p. m. | 560 | 162 | 315 | 132 | 420 | 114 |
| 1.10 p. m. | 595 | 162 | 350 | 144 | 438 | 120 |
| 1.11 p. m. | 560 | 186 | 333 | 138 | 420 | 102 |
| 1.12 p. m. | 578 | 204 | 350 | 132 | 438 | 108 |
| 1.13 p. m. | 560 | 234 | 350 | 144 | 455 | 102 |
| 1.14 p. m. | 560 | 234 | 350 | 150 | 473 | 108 |
| 1.15 p. m. | 560 | 234 | 315 | 144 | 455 | 102 |
| 1.20 p. m. | 350 | 186 | 280 | 120 | 473 | 108 |
| 1.25 p. m. | 560 | 156 | ..... | 60 / 108 | 455 | 120 |
| 1.30 p. m. | 630 | 222 | 337 | 120 | 438 | 120 |
| 1.35 p. m. | 630 | 150 | 298 | 138 | 490 | 102 |
| 1.40 p. m. | 525 | 210 | 280 | 96 | 473 | 138 |
| 1.45 p. m. | 630 | 174 | 280 | 102 | 455 | 120 |
| 1 50 p. m. | 525 | 174 | 210 | 126 | 455 | 114 |
| 1.55 p. m. | 525 | 240 | 245 | 132 | 420 | 102 |
| 2 p. m. | 595 | 210 | 245 | 114 | 403 | 96 |
| 2.05 p. m. | 840 | 216 | 210 | 90 / 120 | 403 | 102 |
| 2.10 p. m. | 560 | 294 | 175 | 114 | 403 | 132 |
| 2.15 p. m. | 770 | 162 | 245 | 120 | 455 | 132 |
| 2.20 p. m. | 840 | 150 | 210 | 72 | 438 | 102 |
| 2.25 p. m. | 700 | 138 | 245 | 72 | 385 | 126 |
| 2.30 p. m. | 595 | 132 | 315 | 84 | 455 | 108 |
| 2.35 p. m. | 735 | 138 | 315 | 30 / 60 | 455 | 114 |
| 2.40 p. m. | 665 | 150 | 280 | 84 | 438 | 108 |
| 2.45 p. m. | 525 | 234 | 245 | 84 | 455 | 108 |
| 2.50 p. m. | 490 | 168 | 245 | 66 | 490 | 126 |
| 2.55 p. m. | 472 | 174 | 245 | 84 | 455 | 126 |
| 3 p. m. | 525 | 114 | 245 | 90 | 438 | 114 |

On October 14th, after a long spell of dry weather, cloudy weather, with brisk easterly winds and threatening rain, prevailed. The values obtained at the Monument and the Signal Office on this date agree closely in character and degree, although much less in degree than those usually obtained. These values are represented in the first diagram of chart number vi.

The second diagram represents the results of the observations made at Boston, Massachusetts, during the month, the numbers corresponding to dates. The third diagram gives the results of the observations made at New Haven, Connecticut.

At Baltimore, Maryland, a continuous photographic record has been obtained. The following notes are abstracted from the observer's report: During October 14–15th stratus clouds covered the sky until about 6.30 a. m. of the 15th. The potential indicated is abnormally low, until the disappearance of the clouds, when it increases rapidly. During rainfall on several occasions the curves show decided variation. A curve characteristic of fair weather with upper clouds is shown by the records of the 17th and 18th. A variation synchronous with a change in wind direction appears on October 18th from 3 to 7 p. m., the wind having changed from sw. to ne., backing through the south points.

At New Haven, Connecticut, negative indications occurred on October 18th, at the 9 a. m. observation, during heavy rain; at 3 p. m. on the 21st, during clear weather, although it had rained during the forenoon; at 9 a. m. of the 26th, during threatening weather, and on the 27th, during heavy rain. Rain with positive values occurred but once, on October 28th, at 3 p. m. The highest values were obtained on October 1st, during clear weather and light northwest winds, and on October 4th, during clear weather and light southwest winds. The lowest values were on October 27th, 11th, and 26th, during rainy weather. The values nearest zero occurred on October 7th, during clear, somewhat hazy weather, with northeasterly winds.

At Boston, Massachusetts, a complete set of observations has been made. On October 2d variations in the potential were noticed at times corresponding with the passage of certain cumulo-stratus clouds. A thunder-storm, with hail, occurred at midnight of the 30th. Negative indications were given on October 4th, at 11 a. m., when there were no clouds, and a fresh west wind was blowing. Negative indications were also observed on the 15th at 11 a. m., during fair weather, following rain; on the 21st, at 11 a. m., during fair weather, with the wind northwest and brisk; on the 28th, at 11 a. m., with threatening weather, and at 3 p. m. of the 31st, preceding by more than an hour, light rain. Rain occurred without negative values on the 27th, 28th, and on the 29th and 30th,

when, however, the values are very low positive. October 14th shows the greatest variation for any one date, and in less marked degree, October 24th.

At Columbus, Ohio, large negative values were obtained on October 4th, during the passage of heavy cumulo-stratus clouds, moving slowly from the southwest, with a slight rain during the night. On October 27th, during light rain, the values were nearly zero. Rain during the night of the 26th was preceded by very low values during the day. The highest positive values were obtained on the 8th and 11th.

At Ithaca, New York, negative values were recorded on October 5th, at 9 a. m., during dense haze. On October 14th, during threatening weather, with high southerly winds, throughout the entire day. On October 17th, at 1 and 3 p. m., following light snow, during which the indications were positive, high negative values were obtained. On October 26th, during threatening weather, and on October 27th, during fog, negative values were obtained. No rain is recorded during the beginning of the month until October 12th, and, with the exception of October 5th, when haze is noted, there were no negative indications for this part of the month. A light rain occurred on the 12th, and a light shower on October 15th, with positive values. Fog and rain on the night of the 27th and morning of the 28th, although preceded by negative and low positive values, were accompanied by high positive values. The highest values obtained were on October 23d, at the last three observations, during clear weather, with fresh, westerly winds; on October 28th, in the morning, during fog and light rain, and on October 12th, in the afternoon, during haze, with light westerly winds.

## OPTICAL PHENOMENA.

### SOLAR HALOS.

Solar halos were observed in the various states and territories, as follows:

*Arizona.*—Fort Apache, 19th.
*Arkansas.*—Little Rock, 21st.
*California.*—San Francisco, 15th, 18th, 19th, 24th, 25th, 28th; Sacramento, 24th.
*Connecticut.*—North Colebrook, 4th.
*Florida.*—Archer, 1st, 2d, 9th; Jacksonville, 8th.
*Georgia.*—Savannah, 3d.
*Idaho.*—Boisé City, 9th, 26th.
*Illinois.*—Riley, 3d, 6th, 11th, 12th, 20th, 22d; Springfield, 3d, 9th.
*Indiana.*—Butlerville, 14th.
*Indian Territory.*—Fort Reno, 25th.
*Iowa.*—Keokuk, 22d.
*Kansas.*—Independence and Westmoreland, 3d; Globe, 3d, 11th, 21st; West Leavenworth, 3d, 21st.
*Kentucky.*—Frankfort, 25th.
*Massachusetts.*—Blue Hill Observatory, 17th.
*Michigan.*—Marquette, 2d, 7th.
*Minnesota.*—Moorhead, 2d.
*Missouri.*—Centreville, 3d.
*Montana.*—Fort Custer, 4th, 29th.
*Nebraska.*—Brownville, 21st.
*Nevada.*—Carson City, 23d, 28th.
*New Jersey.*—Clayton, 4th, 6th, 17th.
*New York.*—Oswego, 4th.
*North Carolina.*—New River Inlet, 8th, 10th, 11th, 13th, 17th, 20th, 26th; Fort Macon, 10th.
*Ohio.*—Wauseon, 3d, 12th; Tiffin, 17th.
*Oregon.*—Roseburg, 26th.
*Pennsylvania.*—Wellsborough, 3d, 26th; Dyberry, 4th.
*South Carolina.*—Stateburg, 3d, 10th, 17th, 21st.
*Tennessee.*—Chattanooga, 4th; Nashville, 4th, 9th, 10th, 25th.
*Utah.*—Frisco, 20th, 28th.
*Virginia.*—Variety Mills, 1st, 4th; Lynchburg, 4th; Cape Henry, 10th, 26th; Dale Enterprise, 10th, 17th, 31st.
*Wisconsin.*—Delavan, 11th.

### LUNAR HALOS.

Lunar halos were observed in the various states and territories, as follows:

*Alabama.*—Mobile, 6th, 12th.
*Arizona.*—Fort Apache, 2d, 28th; Yuma, 8th; Prescott, 9th; Fort Thomas, 10th.
*California.*—San Diego, 10th; Red Bluff, 14th.
*Colorado.*—Las Animas, 6th.
*Connecticut.*—New Haven, 4th; New London, 4th, 8th.
*Dakota.*—Bismarck, 7th.
*Florida.*—Cedar Keys, 4th, 5th, 6th; Limona, 6th; Sanford, 7th; Key West, 7th, 10th, 11th, 12th; Jacksonville, 8th; Archer, 8th, 9th; Pensacola, 9th; Manatee, 10th, 11th, 15th.
*Georgia.*—Savannah and Augusta, 9th.
*Illinois.*—Springfield, Cairo, and Pekin, 3d; Riley, 11th, 13th, 17th; Windsor, 3d, 12th.
*Indiana.*—Jeffersonville and Terre Haute, 3d; Fort Wayne, 11th; Butlerville and Lafayette, 13th.
*Iowa.*—Dubuque, Cedar Rapids, and Urbana, 11th; Clinton, 12th, 17th; Manchester, 16th,
*Kansas.*—El Dorado, Independence, and Westmoreland, 3d; Wyandotte, 3d, 7th, 8th, 9th, 14th; Leavenworth, 8th; Salina, 31st.
*Kentucky.*—Frankfort, 3d, 7th.
*Maine.*—Gardiner, 4th; Cornish, 4th, 11th, 12th, 18th.
*Massachusetts.*—Somerset, 4th, 6th; Cottage City, 5th.
*Michigan.*—Port Huron, 8th, 11th; Grand Haven, 9th, 11th; Detroit, Lansing, and Thornville, 11th.
*Montana.*—Fort Custer, 14th.
*Nebraska.*—North Platte, 4th, 7th; Omaha, 17th; Hay Springs, 18th.
*New Jersey.*—Atlantic City, Clayton, Dover, and Readington, 4th; Egg Harbor City, 4th, 10th; Beverly, 4th, 6th, 15th; Upper Montclair, 5th.
*New Mexico.*—Fort Stanton, 2d, 15th.
*New York.*—Setauket, 4th; Rochester and Oswego, 8th; Factoryville, 9th.
*North Carolina.*—Weldon, 4th; New River Inlet, 4th, 7th, 9th; Wilmington, 6th; Fort Macon and Smithville, 9th, 10th; Kitty Hawk and Hatteras, 10th; Charlotte, 10th, 16th.
*Ohio.*—Tiffin, 3d; Napoleon, 10th, 11th, 13th; Wauseon, 11th.
*Oregon.*—Linkville, 10th; Roseburg, 31st.
*Pennsylvania.*—Wellsborough, 17th.
*Rhode Island.*—Block Island, 4th.
*South Carolina.*—Spartanburg, 1st, 10th, 20th, 21st; Charleston, 9th; Stateburg, 9th, 10th.
*Tennessee.*—Nashville, 10th.
*Texas.*—Palestine, 3d; Galveston, 11th; Fort Elliott, 15th.
*Utah.*—Salt Lake City, 12th.
*Virginia.*—Cape Henry, 4th, 10th; Bird's Nest, 4th, 5th, 10th, 14th; Rappahannock, 7th, 12th, 16th; Lynchburg, 10th; Dale Enterprise, 10th, 14th, 21st.
*Washington Territory.*—Tatoosh Island, 9th.
*Wisconsin.*—Green Bay, 8th; Beloit, 9th to 12th, 14th, 16th; Milwaukee, 12th.
*Wyoming.*—Fort Bridger, 3d, 15th, 25th to 28th.

The phases of the moon (Washington mean time) during October, as given in "The American Ephemeris and Nautical Almanac" for 1886, are as follows: New moon, 26th, 14 h. 7.2 m.; first quarter, 4th, 5 h. 25.2 m.; full moon, 12th, 10 h. 15.7 m.; last quarter, 19th, 21 h. 32.6 m.; apogee, 8th, 8.3 h.; perigee, 24th, 6.7 h.

### MIRAGE.

Saint Vincent, Minnesota: at 8.10 a. m. of the 29th a well-defined mirage was seen to the south; the image of a range of hills known as the "Ridge," distant twenty-five miles, was lifted into view. The phenomenon was visible until 8.30 a. m.

Mirages were also observed on the following dates:
Webster, Dakota, 21st.
Salina, Kansas, 7th, 8th, 11th, 27th, 29th.

Marquette, Nebraska, 26th.
Reidsville, North Carolina, 30th.

## MISCELLANEOUS PHENOMENA.

### DROUGHT.

Harrisburg, Pennsylvania, 21st: throughout the Lebanon Valley very little rain has fallen for several weeks, and many wells and cisterns have become dry. The drought extends over the central portions of the state; farmers in Berks and neighboring counties report the drought to be the severest that has occurred within twenty years. In the Mahanoy Valley one heavy rain only has fallen in nine weeks.

Chattanooga, Tennessee, 23d: dry weather has prevailed in this vicinity during the past six weeks. Farmers state that owing to the dryness of the soil they are unable to plow and that it is impossible to prepare land properly for fall seeding.

Nashville, Tennessee, 25th: a severe drought prevails throughout the central part of the state; streams, wells, and springs have become dry. Only 0.45 inch of rain has fallen since the 28th of September.

Portland, Maine, 25th: a severe drought prevails in this vicinity and throughout the entire state. Many wells are dry and much inconvenience and loss has occurred from the lack of rain.

Kitty Hawk, North Carolina, 26th: a drought has prevailed in this vicinity during the past two months; creeks and springs have become dry and cattle are suffering from want of sufficient water.

Upper Montclair, Essex county, New Jersey: on the 26th heavy rain set in and the long drought was broken. Wells and cisterns had become exhausted and small streams were dry.

Reidsville, Rockingham county, North Carolina: during the past two months the sowing of wheat and rye has been retarded by dry weather. The drought was broken on the 26th by a copious rainfall.

Quakertown, Bucks county, Pennsylvania: on the 26th and 27th 1.60 inches of rain fell, breaking the drought which had become quite severe; many wells and creeks were dry and, on account of the hardness of the soil, farmers have been unable to prepare land for fall seeding.

Chincoteague, Virginia: copious rain fell on the 27th. The continued dry weather had seriously affected the oyster and agricultural interests.

Moorestown, Burlington county, New Jersey, 31st: owing to the prevailing drought wheat and rye sown on the first days of the month have not yet germinated.

Wytheville, Wythe county Virginia: the total rainfall for the months of September and October is only 1.35 inches, while the normal for this station is 6.37 inches. The ground has become thoroughly dried and grain, pasturage, and late vegetables have suffered; streams and wells are very low.

Rappahannock Station, Fauquier county, Virginia: owing to the drought throughout this section much of the land sown in wheat during the first days of the month will have to be resown.

Milan, Gibson county, Tennessee, 31st: during the past six weeks a severe drought has prevailed in this locality, springs and wells are failing and it is necessary, in some parts of the county, to drive stock two and three miles for water.

Milledgeville, Baldwin county, Georgia, 31st: the total rainfall of the past two months is only 0.59 inch, and since August 2d only 2.64 inches of rain have fallen in this locality. Owing to the dry weather fall crops are short, and farmers have been unable to sow small grain.

Livingston, Sumter county, Alabama: the month has been extremely dry; total rainfall, 0.76 inch; owing to the dry weather the season has been very favorable for cotton picking.

The following note in regard to the drought in Alabama is from the October report of the "Alabama Weather Service":

The drought that began the 23d of August has extended through October and continues unabated. This period already is longer by one week than the corresponding drought that occurred in 1884. This season has resulted in good as well as evil to the farming interests throughout the country, because the cotton plant had about completed its growth before the soil became too dry, and the bolls opened rapidly under the warming influence of the sun's rays; the farmer has consequently been enabled to gather the staple in an unstained condition. The drought has, however, been unfavorable to the preparation of market gardens and planting of fall crops.

### FOREST AND PRAIRIE FIRES.

Bismarck, Dakota: on the 3d a prairie fire originated on the line between Hughes and Sully counties and passed over the prairie at the rate of fifteen miles per hour before a strong southerly gale that was prevailing at the time. Ploughed fire guards, from ten to thirty feet wide, did not obstruct the progress of this fire, as ignited "tumble weeds" were blown across and speedily communicated the fire to the grass on the opposite side.

Moorhead, Clay county, Minnesota: on the 6th and 7th prairie fires were burning in this county, destroying much property in the form of hay, wheat stacks, and fencing. Owing to the continued drought and high winds, fires are more frequent and extensive than usual; on the 9th a large area of prairie northeast of Moorhead was burned over and much damage was done in the vicinity of the villages of Hope and Leonard, 35,000 bushels of wheat, considerable farming machinery, and many tons of hay were destroyed.

Sherman, Grayson county, Texas: between the 10th and 15th a large area of prairie in the northeastern corner of the Indian Territory, extending along each side of the Missouri, Kansas, and Texas Railroad, was burned over. A number of cattle were burned, and also large quantities of hay.

Saint Paul, Minnesota: from the 10th to the 18th prairie fires were burning in the Turtle Mountain region, Bottineau county, Dakota, destroying the grass and timber on two hundred square miles of land. Thousands of tons of hay were also destroyed, with a large number of houses, barns, and all kinds of stock, many settlers losing all their possessions. It is reported that the losses will reach $700,000.

Egg Harbor City, Burlington county, New Jersey: the long drought has dried the springs and smaller water courses and made the pine forests very combustible. On the 17th the forest in the southern part of the county was ignited by a spark from a locomotive, the fire spread rapidly over several miles of territory and burned much valuable timber.

Akron, Summit county, Ohio: on the 19th and 20th the "Copley swamps," a large body of marshy land covering several square miles, were burned over, together with several hundred acres of timber and pasture land and many miles of fencing. The soil in the neighborhood of these swamps is composed of muck which burned for several days, in some places to a depth of three feet into the ground.

North Platte, Nebraska: on the 23d an extensive prairie fire occurred in the neighborhood of this station, burning over an area ten miles long by two wide. The fire was accompanied by a high northwesterly wind, maximum velocity twenty-four miles per hour, which caused the fire to spread with great rapidity. Besides burning twenty square miles of valuable prairie grass, 1,500 tons of baled hay were consumed, with many miles of fencing; estimated loss $10,000.

Reading, Pennsylvania: on the 23d, 24th, and 25th extensive forest fires prevailed in the Blue Mountains near this town, burning over 5,000 acres of valuable timber land. The charred remains of a number of cattle were found in the burned district.

Dover, Strafford county, New Hampshire: on the 23d and 24th forest fires burned 1,200 acres of valuable timber land in this vicinity.

Forest and prairie fires have also been reported from the following places:

Linkville, Oregon: forest fire, 27th.

Saint Vincent, Minnesota: prairie fires, 2d, 4th to 9th, 28th.

Moorhead, Minnesota: prairie fires, 11th, 14th, 19th, 23d, 31st.

Yankton, Dakota: prairie fires, 29th, 31st.

Huron, Dakota: prairie fires, 7th.
Fort Shaw, Montana: prairie fires, 6th, 7th.

### METEORS.

Mobile, Alabama: a brilliant meteor, passing from northeast to southwest, was seen at 7.40 p. m. of the 17th. It was followed by a train of light 20° in length and apparently six inches wide. The meteor exploded while in the direction of the constellation Hercules. It was seen by many persons, some asserting that they heard the report of its explosion.

Charleston, South Carolina: a large meteor, apparent diameter six inches, was seen at 9.30 p. m. of the 24th moving from the zenith toward the west; it disappeared at an altitude of 20°.

Meteors were also observed in the various states and territories, as follows:

*Alabama.*—Mobile, 19th.
*California.*—Keeler, 1st, 17th, 27th.
*Florida.*—Limona, 3d, 5th, 27th to 31st.
*Illinois.*—Charleston, 29th; Pekin, 31st.
*Indiana.*—Vevay, 19th; Clinton, 20th; Terre Haute, 31st.
*Kansas.*—Manhattan, 17th; Sterling, 22d; Allison, 27th to 31st; Salina, 31st.
*Kentucky.*—Richmond, 2d, 15th.
*Maryland.*—Woodstock, 1st, 8th, 15th, 19th, 20th to 23d.
*Massachusetts.*—Cottage City, 3d, 11th; Amherst, 9th.
*Michigan.*—Kalamazoo, 2d; Mackinaw City, 30th.
*Nebraska.*—Genoa, 28th.
*New Hampshire.*—Nashua, 21st.
*New Jersey.*—Egg Harbor City, 2d, 17th; Beverly, 25th; Dover, 31st.
*New York.*—North Volney, 23d; Palermo, 31st.
*Ohio.*—Tiffin, 2d, 13th; Wauseon, 19th; Jacksonborough, 24th.
*Oregon.*—Albany, 22d, 28th.
*Pennsylvania.*—York, 13th; Fallsington, 24th.
*South Carolina.*—Stateburg, 15th, 20th, 28th; Spartanburg, 22d, 24th, 25th; Charleston, 28th.
*Texas.*—Cleburne, 17th, 25th.
*Virginia.*—Rappahannock, 10th, 17th; Wytheville, 16th, 18th; Dale Enterprise, 30th.
*Wisconsin.*—Manitowoc, 3d; Madison, 20th; Delavan, 27th.

### MIGRATION OF BIRDS.

*Geese flying southward.*—Lead Hill, Arkansas, 26th; Red Bluff, California, 8th, 10th, 11th, 12th, 14th, 15th, 16th, 19th, 20th, 25th, 26th, 29th, 30th; Cape Henlopen, Delaware, 12th; Cœur d'Alene, Idaho, 14th; Fort Sill, Indian Territory, 20th, 21st; Muscatine, Iowa, 14th; Allison, Kansas, 15th, 16th, 17th; Manhattan, Kansas, 17th; Salina, Kansas, 15th; Liberty Hill, Louisiana, 1st, 16th, 17th, 22d; Ocean City, Maryland, 1st, 15th, 21st; Somerset, Massachussetts, 17th, 31st; Marquette, Michigan, 10th, 15th; Hudson, Michigan, 16th; Moorhead, Minnesota, 1st, 3d; Vicksburg, Mississippi, 25th, 26th; Poplar River, Montana, 20th; North Platte, Nebraska, 24th; Moorestown, New Jersey, 16th; Factoryville, New York, 19th; Ithaca, New York, 13th, 18th, 31st; Kitty Hawk, North Carolina, 28th; Garrettsville, Ohio, 16th; Wauseon, Ohio, 17th; Albany, Oregon, 6th, 7th, 8th, 10th, 11th, 12th, 16th, 29th; East Portland, Oregon, 8th, 19th; Linkville, Oregon, 8th, 9th, 13th, 17th, 23d, 30th, 31st; Roseburg, Oregon, 13th, 23d, 28th; Astoria, Oregon, 22d, 23d, 27th, 28th, 29th; Chattanooga, Tennessee, 26th; Fort Elliott, Texas, 13th; Corsicana, Texas, 13th, 14th, 16th, 26th; Austin, Texas, 24th; San Antonio, Texas, 25th; Cape Henry, Virginia, 19th; Tatoosh Island, Washington Territory, 14th.

*Geese flying northward.*—Pensacola, Florida, 29th; Ocean City, Maryland, 25th; Moorhead, Minnesota, 2d, 31st.

*Ducks flying southward.*—Kitty Hawk, North Carolina, 15th, 20th; Cape Henry, Virginia, 7th, 9th, 24th.

*Cranes flying southward.*—West Leavenworth, Kansas, 15th, 16th, 24th; Fort Elliott, Texas, 14th.

### POLAR BANDS.

Polar bands were reported from the following stations:
Fort Apache, Arizona, 10th.
Montrose, Colorado, 9th.
Archer, Florida, 4th, 14th.
Riley, Illinois, 6th, 28th.
Salina, Kansas, 9th, 11th, 13th.
Gardiner, Maine, 4th, 18th.
Amherst, Massachusetts, 12th.
Fort Macon, North Carolina, 4th, 28th.
Napoleon, Ohio, 11th, 12th.
Wauseon, Ohio, 23d.
Nashville, Tennessee, 3d.
Dale Enterprise, Virginia, 4th.
Wytheville, Virginia, 25th.
Tatoosh Island, Washington Territory, 16th.
Prairie du Chien, Wisconsin, 10th, 11th, 12th, 16th, 17th.

### SAND STORMS.

North Platte, Nebraska: brisk to high southerly winds set in during the afternoon of the 18th; they increased steadily in force, attaining at 8.45 p. m. a velocity of sixty miles per hour. Owing to the prevailing drought heavy clouds of sand and dust were raised by the force of wind, completely hiding the sky from view.

Sand storms also occurred on the following dates:
Yuma, Arizona, 9th, 10th, 18th, 31st.
Fort Verde, Arizona, 15th, 29th.
Keeler, California, 9th, 16th.

### SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and fifty-five stations show 4,763 observations to have been made, of which two were reported doubtful; of the remainder, 4,761, there were 4,341, or 91.2 per cent., followed by the expected weather.

### SUN SPOTS.

Prof. David P. Todd, director of the Lawrence Observatory, Amherst, Massachusetts, furnishes the following record of sun spots for October, 1886:

| Date—October, 1886. Standard time. | No. of new. | | Disappeared by solar rotation. | | Reappeared by solar rotation. | | Total No. visible. | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| | Gr'ps | Spots | Gr'ps | Spots | Gr'ps | Spots | Gr'ps | Spots | |
| 2, 5 p. m... | 0 | 2 | 0 | 0 | ..... | ..... | 1 | 5 | |
| 3, 5 p. m... | 0 | 5‡ | 0 | 0 | 0 | 0 | 1 | 10‡ | |
| 6, 11 a. m... | 1 | 10‡ | 0 | 0 | ..... | ..... | 2 | 15‡ | |
| 7, 4 p. m.. | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 15‡ | |
| 8, 11 a. m... | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10‡ | |
| 10, 12 m..... | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | |
| 11, 4 p. m... | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 5 | |
| 16, 11 a. m... | 1 | 25‡ | ..... | ..... | 0 | 0 | 1 | 25‡ | |
| 20, 12 m ..... | ..... | ..... | ..... | ..... | 0 | 0 | 1 | 1 | |
| 21, 3 p. m... | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 3 | |
| 22, 3 p. m... | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | |
| 24, 4 p. m... | 1 | 6 | 1 | 2 | 1 | 6 | 1 | 6 | |

Faculæ were seen at the time of every observation. ‡Approximated.

Mr. H. D. Gowey, of North Lewisburg, Champaign county, Ohio, reports having observed sun spots on the following dates: 1st, 2d, 5th, 6th, 7th, 10th, 16th, 18th, 22d, 23d, 25th.

Mr. M. A. Veeder, of Lyons, New York, furnishes the following interesting note on sun spots and other phenomena:

On October 3d an extensive area of faculæ came into view by solar rotation, and on October 6th several sun spots had formed in its midst. On October 6th and 7th an aurora, which was quite bright, although somewhat dimmed by strong moonlight, was observed. On these dates also a suspended bar magnet was much agitated at intervals. On the morning of the 8th of October there was a renewal of earthquake activity in South Carolina, and, coincidently, a shock was reported from San Diego, California, which may be regarded as confirmatory of the view expressed in "Nature," for September 16th, at page 465, that when magnetic perturbations and auroras increase there is a corresponding increase in the number of earthquakes. On October 8th also the recent Gulf cyclone crossed the island of Cuba, and on following days moved slowly northwestward. On October 14th two groups of sun spots suddenly appeared in the sun's eastern quadrant. There was a sudden accession of

storm-energy, the southwestern depression uniting with others from the northwest and moving northeastward, with severe gales on the lakes. Preceding this outbreak, and during marked solar activity at the site where the sun spots appeared on the 14th, there had been on the 11th, 12th and 13th considerable agitation of the suspended magnet. On these dates and on October 10th the formation of clouds, moving in distinct layers and with different velocities, had been strongly marked, cumulus being surmounted by long streamers of cirrus, radiating from points toward the west and northwest. From October 3d onward there had not been a day on which cirrus or high stratus had not been observed. On October 4th, 6th, and 7th there was also at some time during the day underlying cumulus or scud.

The rapid formation of spots in the sun's eastern quadrant on October 14th, whilst remaining portions of the sun's surface were almost entirely free from disturbance, nearly fulfills the conditions mentioned in my last communication in regard to the occurrence of a "cold wave" of energetic character and wide extent, when a disturbed portion of the sun has come into view, following a portion comparatively calm. It seems to be a general rule that a single energetic disturbance upon the solar surface has a much more marked and distinguishable influence upon atmospheric conditions than has a succession of such disturbances.

It will be understood that in presenting these points as bearing upon the causes of general atmospheric perturbations with incidental local storms the writer regards tham as of a tentative nature. Although he has given some attention to these matters for seven or eight years past he is not fully satisfied as to the possibility of tracing out satisfactorily the influence of cosmical agencies as affecting the weather in individual instances. Coincidences of the character indicated in these notes constitute valid proof only when sufficiently multiplied.

### WATER-SPOUTS.

Capt. Chas. Acocks, commanding the bark "Mary," on the 6th, in N. 34° 42′, W. 74° 43′ (at noon), saw a large water-spout in the morning.

The bark "Julius," on the 8th, at 10 p. m., in N. 20° 52′, W. 83° 50′, was struck forward by a water-spout, lasting only three minutes, which knocked one of the crew on lookout from forecastle to lower deck, and, passing around port side of vessel, went clear without causing any damage.

Capt. Samuel Hess, commanding the s. s. "Philadelphia," gives the following interesting description of a water-spout: "October 16th, at 3 p. m., civil time, in N. 27° 34′, W. 69° 48′, observed a most remarkable and well-defined water-spout; computed height, or length of spiral column of water, from observations by sextant, sixteen hundred feet; elapsed time from beginning to end, forty-five minutes; movement northwest. The weather was fine, with light airs from northeast. After the spout broke the clouds suddenly spread themselves overhead, and heavy showers of rain fell for half an hour, accompanied with fresh breezes from southeast."

## VERIFICATIONS.

### INDICATIONS.

The indications for October, 1886, were made by 2d Lieutenant J. E. Maxfield, Signal Corps, U. S. Army, Assistant, and were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant.

The detailed comparison of the tri-daily indications for October, 1886, with the telegraphic reports during the twenty-four hours for which the indications were prepared, shows the general average percentage of verifications to be 81.51. The percentages for the different elements are: Weather, 85.29; wind, 73.39; temperature, 78.82. By states, etc., the percentages are: For Maine, 77.26; New Hampshire, 77.12; Vermont, 78.04; Massachusetts, 76.85; Rhode Island, 76.29; Connecticut, 79.69; New York, 81.45; Pennsylvania, 80.22; New Jersey, 81.18; Delaware, 80.62; Maryland, 81.77; District of Columbia, 79.73; Virginia, 80.99; North Carolina, 88.18; South Carolina, 85.51; Georgia, 87.98; Florida, 85.37; Alabama, 87.58; Mississippi, 84.75; Louisiana, 86.02; Texas, 88.76; Arkansas, 84.30; Tennessee, 84.78; Kentucky, 85.83; Ohio, 84.48; West Virginia, 79.06; Indiana, 84.86; Illinois, 84.50; Michigan, 83.09; Wisconsin, 75.48; Minnesota, 76.10; Iowa, 74.18; Kansas, 76.13; Nebraska, 73.71; Missouri, 82.35; Colorado, 73.47; east Dakota, 72.02.

There were ten omissions to predict, out of 9,951, or 0.10 per cent. Of the 9,941 predictions that have been made, five hundred and one, or 5.04 per cent., are considered to have entirely failed; four hundred and thirty-nine, or 4.42 per cent., were one-fourth verified; 1,589, or 15.98 per cent., were one-half verified; 1,793, or 18.04 per cent., were three-fourths verified; 5,619, or 56.52 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

In the table below are shown for the Pacific coast the percentages of indications for the months of July, August, and September, 1886. The indications for the three months were made by 2d Lieutenant W. A. Glassford, Signal Corps, U. S. Army, Assistant; those for July and September were verified by 2d Lieutenant J. E. Maxfield, Signal Corps, U. S. Army, Assistant; those for August were verified by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant:

*Percentages of indications verified.*

| Districts. | July. | August. | September. |
|---|---|---|---|
| Washington Territory | 84.30 | 79.62 | 83.49 |
| Oregon | 84.12 | 82.39 | 84.69 |
| Northern California | 90.91 | 83.25 | 92.14 |
| Southern California | 89.66 | 84.21 | 92.14 |

### CAUTIONARY SIGNALS.

During October, 1886, the total number of signals ordered of all kinds, the verifications of which were determined, was one hundred and fifteen, of these, sixty-two, or 53.91 per cent., were fully verified both as to direction and velocity. Of the above, fifteen were ordered for on-shore winds, number verified, eleven, or 73.33 per cent.; three were ordered for northeasterly winds, number verified, none; twelve were ordered for southwesterly winds, number verified, three, or 25.00 per cent.; eight were ordered for northwesterly winds, number verified both as to direction and velocity, five, or 62.50 per cent., verified as to velocity only, one, or 12.50 per cent.; seventy-seven were ordered for winds without regard to direction, number verified, forty-three, or 55.84 per cent.; four, or 3.50 per cent., were ordered late, *i. e.*, after the verifying velocity had begun.

In twenty-one cases winds occurred which would have justified the display of cautionary signals but for which they were not ordered, and in fifteen instances winds which would have justified the display of on-shore signals, but for which they were not ordered.

In addition to the above, two hundred and eighteen signals were ordered at display stations, the verification of which it was impracticable to determine.

### COLD-WAVE SIGNALS.

During October, 1886, the total number of cold-wave signals ordered, the verifications of which were determined, was ninety-three; number verified, fifty-six, or 60.22 per cent. Twenty signals were ordered, the verifications of which it was impracticable to determine. In addition to the above, in one hundred and forty-four instances, the signals ordered from this office were repeated by the observers at the regular stations to towns in their vicinity. The verification of these it was impracticable to determine.

### RAILWAY WEATHER SIGNALS.

P. H. Mell, jr., director of the "Alabama Weather Service," in the report for October, 1886, states:

The verification of predictions for the whole area was 97 per cent. for temperature, and 96 per cent. for weather.

The following corporations comprise this system: South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus and Western; Atlanta and West Point of Georgia; Northeastern of Georgia; Western and Atlantic; East Tennessee, Virginia and Georgia system in Georgia; Montgomery and Eufaula; Pensacola and Selma; Pensacola and Atlantic; the cities of Milledgeville, Georgia, and Talladega, Alabama.

J. D. Plunkett, M. D., President of the Tennessee Board of Health, in the bulletin for October, 1886, states:

The percentage of verifications of weather predictions as telegraphed from the Signal Office at Washington, and displayed by signal flags at various stations in the state are: for temperature, 90°.3; for weather, 87°.6.

The following is from the "Bulletin of the New England Meteorological Society" for October, 1886:

Verification of weather signals at New Haven was 81 per cent. for temperature, 87° for weather; at seven stations reporting to the Boston Signal Office, 90° for temperature, 94° for weather.

## ERRATUM.

In the "REVIEW" for September, 1886, on page 250, under "Deviations from normal temperatures," at Wytheville, Virginia, instead of "The mean temperature of the nine months, ending September 30th, 37°.6, is 4°.5 above the normal," read, the total precipitation of the nine months, ending September 30th, 37.56 inches, is 4.46 inches above the normal.

*Meteorological record of voluntary observers and Army post surgeons, October, 1886.*

The maximum and minimum temperatures at stations marked thus (*) are from readings of other than standard instruments.

| Stations. | Temperature. Maximum. | Minimum. | Mean. | Rainfall. |
|---|---|---|---|---|
| *Alabama.* | ° | ° | ° | *Inches* |
| Greensborough | 78 | 41 | 67.4 | 1.59 |
| Livingston | 85 | 31 | 66.4 | 0.76 |
| Mount Vernon B'ks. | 91 | 35 | 69.2 | 0.00 |
| *Arizona.* | | | | |
| Huachuca, Fort | 85 | 33 | 62.4 | 0.84 |
| Lowell, Fort | 97 | 32 | 68.8 | 0.12 |
| McDowell, Fort | 101 | 37 | 68.7 | 0.30 |
| *Arkansas.* | | | | |
| Lead Hill | 98 | 24 | 58.3 | 0.10 |
| *British Columbia.* | | | | |
| New Westminster | 68 | 34 | 48.4 | 5.28 |
| *California.* | | | | |
| Alcatraz Island | 74 | 45 | 55.0 | 1.30 |
| Angel Island | 83 | 42 | 57.9 | 1.49 |
| Benicia Barracks | 81 | 44 | 59.6 | 1.46 |
| Bidwell, Fort | 76 | 25 | 47.0 | 1.93 |
| Cahuenga | | | | 0.05 |
| Gaston, Fort | 83 | 24 | 53.8 | 3.36 |
| Hydesville | | | | 3.06 |
| Mason, Fort | 71 | 46 | 57.0 | 1.09 |
| Nicolaus | 92 | 41 | 60.0 | 0.89 |
| Oroville | 87 | 43 | 62.2 | 0.63 |
| Poway | 83 | 40 | 57.0 | 0.10 |
| Presidio of San F | 74 | 42 | 55.4 | 0.44 |
| Princeton | | | | 0.53 |
| Sacramento | 80 | 36 | 54.8 | 0.79 |
| Salinas | 69 | 39 | 52.5 | 0.62 |
| Susanville | 73 | 32 | 50.0 | 1.32 |
| *Colorado.* | | | | |
| Colorado Springs | 76 | 22 | 50.6 | 0.28 |
| Lewis, Fort | 68 | 22 | 45.3 | 2.02 |
| *Connecticut.* | | | | |
| Bethel | | | | 2.32 |
| North Colebrook | 75 | 18 | 50.1 | 1.32 |
| Voluntown | 80 | 20 | | 4.70 |
| *Dakota.* | | | | |
| Abr. Lincoln, Fort | 85 | 17 | 47.8 | 0.80 |
| Henry | 81 | 24 | 50.3 | 1.06 |
| Pembina, Fort | 83 | 12 | 45.4 | 1.10 |
| Randall, Fort | 85 | 15 | 55.4 | 0.91 |
| Richardton | 80 | 24 | 45.1 | 0.80 |
| Sisseton, Fort | 80 | 19 | 49.1 | 1.00 |
| Sully, Fort | 91 | 23 | 52.6 | 0.45 |
| Totten, Fort | 82 | 19 | 46.9 | 1.38 |
| Webster | 85 | 20 | 51.1 | 1.77 |
| Yates, Fort | 85 | 10 | 48.6 | 0.70 |
| *District of Columbia.* | | | | |
| Distributing Res'r* | 80 | 35 | 58.9 | 1.19 |
| Kendall Green* | 79 | 42 | 56.2 | 0.88 |
| Receiving Res'r'r* | 79 | 36 | 58.4 | 1.13 |
| Rock Creek Bridge* | 84 | 38 | 61.2 | |
| *Florida.* | | | | |
| Alva* | 88 | 55 | 71.4 | 3.55 |
| Archer* | 92 | 38 | 72.7 | 2.11 |
| Limona* | 90 | 50 | 75.5 | 2.64 |
| Merritt's Island | 89 | 58 | 73.7 | 11.94 |
| Manatee | 93 | 53 | 75.0 | 3.90 |
| Meade, Fort | | | | 2.54 |
| Tallahassee | 80 | 44 | 68.5 | 2.66 |
| *Georgia.* | | | | |
| Athens | 84 | 33 | 61.3 | 0.01 |
| Forsyth* | 90 | 42 | 68.4 | 0.35 |
| Milledgeville | 83 | 34 | 64.0 | trace |
| Quitman | 83 | 41 | | 0.30 |
| *Idaho.* | | | | |
| Boisé Barracks | 87 | 27 | 53.0 | 0.42 |
| Coeur d'Alene, Fort | 77 | 25 | 45.0 | 2.05 |
| *Illinois.* | | | | |
| Anna* | 83 | 34 | 61.1 | 0.74 |
| Bloomington | 78 | 30 | | 0.78 |
| Collinsville | 82 | 31 | 58.1 | 0.78 |
| Charleston* | 88 | 30 | 56.6 | 0.74 |
| Genesco* | 84 | 26 | 55.2 | 2.36 |
| Mattoon* | 86 | 32 | 60.0 | 1.05 |
| Pekin* | 86 | 27 | 57.1 | 1.38 |
| Peoria | 84 | 32 | 58.4 | 1.81 |
| Riley | 80 | 26 | 52.2 | 2.55 |
| Rockford | 80 | 27 | 52.2 | 4.03 |
| Sandwich | 84 | 29 | 54.5 | 1.65 |
| South Evanston | 84 | 25 | | 1.46 |
| Sycamore | 81 | 27 | 50.6 | 2.26 |
| Windsor | 84 | 29 | 53.6 | 1.04 |
| *Indian Territory.* | | | | |
| Gibson, Fort | 83 | 24 | 62.8 | 2.75 |
| Reno, Fort | 80 | 28 | 62 4 | 4.17 |
| Supply, Fort | 85 | 24 | 61.2 | 1.32 |
| *Indiana.* | | | | |
| Butlerville* | 85 | 32 | | 1.68 |
| Fort Wayne* | 83 | 32 | 54.3 | 1.20 |
| Jeffersonville | 82 | 32 | 56.2 | 0.62 |
| Laconia | 84 | 30 | 55.7 | 0.55 |
| Lafayette | 85 | 28 | 53.5 | 0.73 |
| La Grange | 79 | 31 | 52.9 | 2.07 |
| Logansport* | 86 | 34 | 56.2 | 1.30 |
| Mauzy | 79 | 23 | 46.5 | 1.10 |
| Monticello | 84 | 32 | 54.4 | |
| Sunman* | 78 | 29 | 54.3 | 1.23 |
| Terre Haute* | 79 | 32 | | 0.21 |
| Vevay | 85 | 33 | 56.6 | 0.91 |
| *Iowa.* | | | | |
| Bancroft | 84 | 20 | 54.0 | 0.48 |
| Cedar Rapids *a* | 82 | 22 | 53.6 | 4.92 |
| Cedar Rapids *b* | 85 | 18 | 52.5 | 5.00 |
| Cresco | 81 | 22 | 51.8 | 1.72 |
| Clinton | 86 | 24 | 52.7 | 4.29 |
| Des Moines | 86 | 23 | 56.9 | |
| Independence* | 78 | 29 | 52.7 | 3.60 |
| Logan | 88 | 22 | | 3.80 |
| Madison, Fort | 82 | 30 | | 3.40 |
| Manchester* | 85 | 25 | 54.9 | 8.15 |
| Monticello* | 86 | 23 | 53.0 | 5.34 |
| Mount Vernon | 88 | 27 | 56.7 | |
| Muscatine | 85 | 26 | | 4.70 |
| Oskaloosa* | 85 | 27 | 56.0 | 3.20 |
| Urbana | 80 | 32 | 53.9 | 4.45 |
| West Union | 83 | 22 | 51.7 | 3.30 |
| *Kansas.* | | | | |
| Allison | 94 | 17 | 57.2 | 0.12 |
| Belleville | | | | 1.83 |
| El Dorado | 82 | 24 | 59.4 | 2.13 |
| Elk Falls | | | | 1.62 |
| Emporia | 83 | 33 | 60.0 | 1.70 |
| Globe | 86 | 25 | 60.0 | |
| Hays, Fort | 83 | 16 | 58.4 | 1.44 |
| Independence* | 87 | 28 | 59.8 | 1.02 |
| Manhattan *a* | 88 | 22 | 58.5 | 2.25 |
| Manhattan *b* | 91 | 25 | 61.0 | 2.42 |
| Riley, Fort | 87 | 24 | 61.8 | 1.74 |
| Sterling | 82 | 32 | 57.7 | 2.00 |
| Salina | 80 | 42 | 62.4 | 2.03 |
| Wellington | 84 | 23 | 56.8 | 1.29 |
| West Leavenworth | 88 | 28 | | 3.10 |
| Westmoreland* | 98 | 24 | 59.0 | 1.62 |
| Wyandotte | 88 | 24 | 60.3 | 1.45 |
| *Kentucky.* | | | | |
| Bowling Green | 83 | 39 | | 0.78 |
| Frankfort | 88 | 30 | 54.5 | 0.89 |
| Richmond | 81 | 32 | 56.4 | 0.78 |
| *Louisiana.* | | | | |
| Grand Coteau | 90 | 43 | 66.9 | 2.73 |
| Liberty Hill | | | | 2.17 |
| Luling* | 88 | 43 | | 0.70 |
| *Maine.* | | | | |
| Cornish* | 76 | 20 | 46.7 | 5.10 |
| Gardiner | 78 | 23 | 46.4 | 3.67 |
| Kent's Hill | 69 | 22 | 44.4 | 3.24 |
| Orono* | 75 | 21 | 45.5 | 1.42 |
| *Maryland.* | | | | |
| Cumberland | 75 | 34 | 50.6 | 0.50 |
| Fallston* | 81 | 33 | 56.2 | 2.24 |
| Great Falls* | 80 | 32 | 56.0 | 2.31 |
| McDonogh | 77 | 31 | 57.1 | 1.52 |
| McHenry, Fort | 75 | 34 | 58.7 | 1.42 |
| Woodstock | 77 | 28 | 54.3 | 1.90 |
| *Massachusetts.* | | | | |
| Amherst *a* | 78 | 17 | 48.9 | 2.97 |
| Amherst *b* | 76 | 24 | 49.7 | 3.06 |
| Blue Hill Obs'y | 77 | 25 | 49.5 | 4.87 |
| Deerfield | 78 | 20 | 49.8 | 3.72 |
| Dudley | 79 | 36 | 58.0 | 1.73 |
| Fall River | 76 | 26 | 51.1 | 4.59 |
| Milton | 76 | 20 | 48.2 | 3.89 |
| New Bedford | 76 | 24 | 51.8 | 4.49 |
| North Truro | | | | 4.93 |
| Princeton | 75 | 22 | 47.7 | 2.87 |
| Somerset* | 81 | 24 | 52.9 | 3.82 |
| Taunton | 84 | 21 | 51.1 | 3.13 |
| Worcester | 73 | 34 | 48.0 | 2.75 |
| Westborough | 81 | 20 | 53.0 | 2.98 |
| Williamstown | 72 | 25 | 49.3 | 2.60 |
| *Michigan.* | | | | |
| Brady, Fort | 78 | 23 | 47.4 | 5.69 |
| Harrisville* | 78 | 27 | | 1.57 |

*Meteorological record of voluntary observers, etc.*—Continued.

| Stations. | Temperature. Maximum. | Minimum. | Mean. | Rainfall. |
|---|---|---|---|---|
| *Michigan*—Cont'd. | ° | ° | ° | *Inches* |
| Hudson | 81 | 28 | | 1.67 |
| Kalamazoo | 75 | 36 | 55.5 | 1.39 |
| Lansing | 79 | 31 | 51.8 | 1.15 |
| Mottville | 80 | 30 | 63.5 | |
| Pentwater | 83 | 16 | 50.7 | 3.58 |
| Thornville | 79 | 35 | 52.2 | 1.61 |
| Traverse City | 81 | 27 | | 4.57 |
| *Minnesota.* | | | | |
| Minneapolis | 81 | 24 | 52.0 | 0.46 |
| Snelling, Fort | 85 | 32 | 55.4 | 0.80 |
| *Missouri.* | | | | |
| Centreville | 80 | 19 | | 0.96 |
| Central College* | 82 | 27 | | 1.99 |
| Oregon | 86 | 27 | 60.6 | 5.41 |
| *Montana.* | | | | |
| Assinaboine, Fort | 82 | 22 | 46.3 | 0.11 |
| Keogh, Fort | 89 | 25 | 48.5 | 1.36 |
| Missoula, Fort | 72 | 21 | 43.8 | 0.58 |
| Shaw, Fort | 83 | 19 | 46.4 | 0.94 |
| *Nebraska.* | | | | |
| Brownville | 88 | 31 | 60.5 | 4.37 |
| Crete | 87 | 21 | 57.0 | 0.71 |
| De Soto* | 90 | 23 | 57.7 | 2.74 |
| Fairbury | 93 | 42 | | 1.93 |
| Fremont* | 85 | 24 | 56.5 | 0.95 |
| Genoa | 81 | 31 | 55.9 | 1.43 |
| Lincoln | 84 | 22 | 57.6 | 0.68 |
| Hay Springs* | 83 | 23 | 47.2 | 0.37 |
| Marquette | | | | 0.14 |
| Niobrara, Fort | 85 | 18 | 51.7 | 0.26 |
| Robinson, Fort | 88 | 12 | 49.8 | 0.31 |
| Sidney, Fort | 79 | 21 | 49.4 | 0.40 |
| Stockham | | | | 0.20 |
| *Nevada.* | | | | |
| Carson City | 77 | 18 | 46.2 | 0.21 |
| Halleck, Fort | 76 | 18 | 42.6 | 2.36 |
| McDermit, Fort | 79 | 30 | 47.4 | 1.90 |
| *New Hampshire.* | | | | |
| Antrim | | | | 3.60 |
| Ashland | | | | 3.53 |
| Belmont | | | | 2.53 |
| Berlin Mills | 75 | 13 | | 1.62 |
| Bristol | | | | 3.28 |
| Lake Village | | | | 3.02 |
| Nashua | 79 | 21 | 48.9 | 2.37 |
| Wier's Bridge | | | | 3.58 |
| Wolfborough | | | | 3.00 |
| Woodstock | | | | 3.01 |
| *New Jersey.* | | | | |
| Beverly* | 89 | 29 | 55.9 | 2.80 |
| Clayton* | 88 | 24 | 54.8 | 2.32 |
| Dover* | 83 | 21 | 49.5 | 2.02 |
| Egg Harbor City | 82 | 20 | 55.9 | 3.15 |
| Moorestown | 81 | 22 | 54.0 | 2.47 |
| Readington* | 82 | 30 | 58.5 | 1.80 |
| Roseland | | | | 3.07 |
| South Orange | 78 | 28 | 54.3 | 2.40 |
| Upper Montclair | 79 | 20 | 55.2 | 3.40 |
| Vineland | 77 | 34 | 57.1 | 2.88 |
| *New Mexico.* | | | | |
| Bayard, Fort | 82 | 39 | 58.4 | 1.60 |
| Gallinas Spring | 78 | 45 | | 1.26 |
| Selden, Fort | 86 | 30 | 60.8 | 2.27 |
| Union, Fort | 75 | 27 | 51.3 | 0.90 |
| Wingate, Fort | 78 | 25 | 49.1 | 1.50 |
| *New York.* | | | | |
| Auburn | 73 | 33 | 51.0 | 2.85 |
| Brooklyn | 78 | 32 | 55.4 | 3.40 |
| Cooperstown* | 72 | 29 | 48.0 | 2.54 |
| David's Island | | 30 | 56.4 | 2.18 |
| Factoryville* | 77 | 24 | 49.6 | 1.85 |
| Ithaca | 75 | 24 | 50.6 | 2.28 |
| Le Roy | 77 | 24 | 49.8 | 1.74 |
| Madison Barracks | 71 | 26 | 50.0 | 1.44 |
| Niagara, Fort | 76 | 32 | 51.6 | 0.77 |
| North Volney* | 75 | 31 | 49.8 | |
| Palermo* | 79 | 31 | 47.4 | 1.85 |
| Palmyra* | 78 | 34 | 52.0 | |
| Penn Yan | | | | 1.90 |
| Plattsburg B'ks | 72 | 20 | 47.6 | 0.76 |
| Syracuse | 78 | 31 | | |
| Setauket | 76 | 31 | 55.5 | 4.15 |
| White Plains | 75 | 24 | 55.2 | 2.49 |
| *North Carolina.* | | | | |
| Chapel Hill | 80 | 35 | 58.7 | 1.47 |
| Flat Rock | 75 | 34 | 53.0 | 0.17 |
| Lenoir | 80 | 35 | | 1.00 |
| Lincolnton | 73 | 41 | 53.6 | 0.21 |
| Raleigh | 88 | 42 | 62.0 | 0.90 |
| Reidsville* | 89 | 30 | 55.2 | 0.55 |
| Statesville* | 78 | 37 | 56.9 | 0.36 |
| Wake Forest | 85 | 35 | 60.3 | 2.36 |
| Weldon* | 83 | 40 | 58.8 | 2.38 |
| *Ohio.* | | | | |
| Cleveland | 80 | 35 | 53.6 | 0.74 |
| College Hill* | 93 | 36 | 55.8 | 1.25 |
| Elyria | 83 | 32 | 05.7? | 1.31 |
| Garrettsville | 79 | 25 | 49.1 | 0.87 |
| Hiram | 78 | 30 | 53.0 | 1.28 |
| Jacksonborough* | 80 | 31 | 53.1 | 1.55 |
| Napoleon | 80 | 33 | 54.4 | 1.42 |
| *Ohio*—Cont'd. | ° | ° | ° | *Inches* |
| North Lewisburg | 83 | 31 | 55.7 | 1.80 |
| Portsmouth | 80 | 35 | 53.5 | 1.25 |
| Ruggles* | 75 | 26 | 52.3 | 0.80 |
| Tiffin* | 81 | 31 | 50.1 | 1.23 |
| Westerville | 77 | 30 | 51.4 | 1.33 |
| Wauseon | 84 | 29 | 52.0 | 1.94 |
| West Milton | 88 | 30 | 54.0 | 3.00 |
| Yellow Springs | 74 | 30 | 52.6 | 1.46 |
| *Oregon.* | | | | |
| Albany* | 77 | 36 | 51.3 | 3.28 |
| Bandon* | 62 | 32 | 47.0 | 5.87 |
| Eola* | 74 | 34 | 50.0 | 3.12 |
| East Portland* | 70 | 37 | | 3.12 |
| La Grande | 80 | 28 | | 1.49 |
| Mount Angel* | 73 | | 50.0 | |
| *Pennsylvania.* | | | | |
| Altoona | 80 | 30 | 51.9 | 0.74 |
| Blooming Grove* | 78 | 24 | | 2.90 |
| Bethlehem* | 84 | 29 | 55.6 | 2.18 |
| Catawissa* | 80 | 27 | 53.2 | 2.84 |
| Dyberry | 75 | 22 | 49.0 | 2.42 |
| Easton | | | | 2.37 |
| Fallsington | 80 | 29 | 53.6 | 2.90 |
| Franklin* | 72 | 28 | 44.7 | 1.20 |
| Germantown* | 79 | 33 | | 2.71 |
| Grampian Hills* | 76 | 26 | 50.4 | 0.97 |
| Mahanoy Plane | 77 | 39 | 55.8 | 3.35 |
| Philipsburg* | 62 | 26 | 43.0 | 1.70 |
| Quakertown | 76 | 24 | 53.3 | 2.65 |
| Wellsborough* | 75 | 30 | 51.2 | 1.88 |
| West Chester | 80 | 27 | 55.0 | 3.06 |
| Wysox | 74 | 32 | 53.0 | 2.21 |
| York | | 34 | 68.8 | 0.91 |
| Zionsville | 84 | 32 | 61.4 | 2.71 |
| *South Carolina.* | | | | |
| Aiken | 89 | 60 | 76.7 | 1.55 |
| Kirkwood* | 77 | 24 | 58.0 | 0.39 |
| Pacolet | 76 | 41 | 59.7 | 0.00 |
| Spartanburg | 75 | 48 | 61.7 | 0.06 |
| Statesburg* | 82 | 38 | 63.0 | 2.02 |
| *Tennessee.* | | | | |
| Ashwood | 82 | 33 | 60.5 | 0.32 |
| Milan | 83 | 30 | 57.5 | 0.90 |
| *Texas.* | | | | |
| Austin* | 89 | 42 | 69.1 | 0.25 |
| Cleburne | 86 | 29 | 68.0 | 0.37 |
| Comfort | | | | 1.75 |
| Concho, Fort | 89 | 39 | 66.6 | 1.35 |
| Corsicana | | | | 2.53 |
| McIntosh, Fort | 92 | 47 | 72.6 | |
| Midland | 85 | 44 | 64.0 | 0.76 |
| Ringgold, Fort | 90 | 44 | 76.1 | trace |
| New Ulm | 92 | 42 | 69.1 | 0.92 |
| Silver Falls | 82 | 42 | | 3.44 |
| *Vermont.* | | | | |
| Brattleborough | 79 | 18 | 49.5 | 4.14 |
| Burlington | 76 | 26 | 49.4 | 1.25 |
| Charlotte* | 76 | 30 | 42.8 | 1.50 |
| Lunenburg | 72 | 23 | 47.4 | 1.40 |
| Newport | 75 | 22 | 46.3 | 2.24 |
| Post Mills* | 76 | 16 | 43.0 | 1.85 |
| Poultney | 76 | 19 | 47.8 | 2.40 |
| Strafford | 73 | 20 | 49.0 | 2.03 |
| *Virginia.* | | | | |
| Accotink | 81 | 33 | 55.4 | 0.99 |
| Bird's Nest* | 85 | 48 | 53.9 | 2.05 |
| Bruington | | | | 1.83 |
| Dale Enterprise* | 88 | 32 | 61.3 | 2.54 |
| Marion | 78 | 34 | 54.0 | 0.63 |
| Monroe, Fort | 80 | 44 | 62.8 | 2.20 |
| Rappahannock | 85 | 36 | 62.3 | 1.00 |
| Snowville | 78 | 28 | | 1.12 |
| Summit | 82 | 28 | 56.0 | |
| University of Va | 72 | 44 | 58.3 | 0.80 |
| Variety Mills | 81 | 30 | 52.8 | 1.07 |
| Wytheville | 77 | 29 | 52.9 | 0.87 |
| *Washington Territory.* | | | | |
| Bainbridge Island* | 72 | 40 | 53.2 | 3.00 |
| Kenewick | 81 | 24 | | 1.17 |
| Spokane, Fort | 83 | 22 | 48.9 | 0.58 |
| Tacoma* | 64 | 34 | 50.9 | 3 78 |
| Townsend, Fort | 68 | 33 | 49.5 | 2.61 |
| Walla Walla, Fort | 81 | 32 | 52.2 | 1.88 |
| *West Virginia.* | | | | |
| Clarksburg | 72 | 28 | 53.0 | 0.80 |
| Helvetia* | 78 | 29 | 49.6 | 1.35 |
| Parkersburg | 80 | 35 | 52.8 | 0.83 |
| *Wisconsin.* | | | | |
| Beloit | 80 | 27 | 52.3 | 2.60 |
| Delavan | 81 | 24 | 53.5 | 2.70 |
| Embarrass* | 82 | 25 | 53.8 | 5.85 |
| Fond du Lac* | 82 | 20 | 51.0 | 1.97 |
| Lancaster | 84 | 24 | 52.8 | |
| Madison | 80 | 31 | 52.4 | 3.21 |
| Manitowoc | 72 | 29 | 54.1 | 3.86 |
| Prairie du Chien | 85 | 24 | 54.1 | 4.33 |
| Wausau | 77 | 21 | 49.5 | 3.21 |
| *Wyoming.* | | | | |
| Laramie, Fort | 81 | 23 | 50.2 | 0.04 |

## NOTES AND EXTRACTS.

### DIFFERENCES OF STILL AND WHIRLED PSYCHROMETERS.

[By Junior Prof. T. RUSSELL.]

A number of Signal Service stations have recently been supplied with whirling psychrometers. The readings of these and of the still psychrometers made at the same time show the extent to which the two differ.

The whirling machines, on which the whirled wet and dry bulbs are mounted, are set up inside the shelters in which the still thermometers are placed. The shelters in most places are set up on the roofs of buildings and about eight to twelve feet above the roof. The shelter is a single louvre structure three and a half feet by three feet, and three feet in height, with a double top, a closed bottom, and door opening to the north.

The still thermometers have spherical bulbs and the whirled ones cylindrical bulbs.

Corrections have been applied to the thermometer readings for instrumental error in all the readings except those of the dry-bulb still thermometer at San Francisco. That instrument was never compared with a standard.

Whirling is intended to diminish the effect on the bulbs of the thermometers of radiation from the sides of the shelter when the sides happen to be warmer or colder than the air. It is also intended to obviate the bad effects on the readings of wet-bulb thermometers arising from an insufficient renewal of the air around the wet-bulbs, especially at times when there is not much wind prevailing.

Table I gives the mean differences, for the months of August and September, between the dry-bulb thermometers, still and whirled.

TABLE I.—*Differences of still and whirled dry-bulb thermometers, in degrees Fahrenheit. August and September*, 1886.

[Plus sign indicates still reads higher than whirled.]

| Station. | Month. | 3 a. m. | 7 a. m. | 11 a. m. | 3 p. m. | 7 p. m. | 11 p. m. |
|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | ° | ° | ° |
| Albany | Aug. | ..... | + 0.4 | ..... | 0.0 | ..... | 0.0 |
| Do | Sept. | ..... | + 0.2 | ..... | — 0.2 | ..... | + 0.1 |
| Baltimore | Aug. | ..... | + 0.1 | ..... | + 0.1 | ..... | 0.0 |
| Do | Sept. | ..... | + 0.2 | ..... | + 0.1 | ..... | + 0.1 |
| Boston | Aug. | + 0.2 | 0.0 | + 0.1 | 0.0 | + 0.1 | + 0.1 |
| Do | Sept. | 0.0 | + 0.1 | 0.0 | 0.0 | + 0.1 | + 0.1 |
| Buffalo | Aug. | ..... | + 0.2 | ..... | + 0.2 | ..... | + 0.1 |
| Do | Sept. | ..... | + 0.2 | ..... | + 0.2 | ..... | + 0.1 |
| Cedar Keys | Aug. | ..... | — 0.1 | ..... | — 0.1 | ..... | — 0.1 |
| Do | Sept. | ..... | — 0.2 | ..... | — 0.2 | ..... | — 0.2 |
| Charleston | Aug. | ..... | + 0.4 | ..... | + 0.3 | ..... | + 0.1 |
| Do | Sept. | ..... | + 0.1 | ..... | + 0.2 | ..... | 0.0 |
| Cincinnati | Aug. | ..... | — 0.6 | ..... | — 0.5 | ..... | — 0.5 |
| Do | Sept. | ..... | — 0.3 | ..... | — 0.4 | ..... | — 0.4 |
| Chattanooga | Aug. | ..... | — 0.5 | ..... | — 0.5 | ..... | — 0.3 |
| Do | Sept. | ..... | 0.0 | ..... | — 0.2 | ..... | — 0.1 |
| Cleveland | Aug. | ..... | — 0.1 | ..... | — 0.3 | ..... | 0.0 |
| Do | Sept. | ..... | — 0.3 | ..... | — 0.1 | ..... | 0.0 |
| Columbus, Ohio | Aug. | ..... | 0.0 | ..... | 0.0 | ..... | + 0.1 |
| Do | Sept. | ..... | + 0.1 | ..... | + 0.1 | ..... | 0.0 |
| Davenport | Sept. | ..... | — 0.1 | ..... | + 0.1 | ..... | — 0.1 |
| Denver | Aug. | ..... | + 0.2 | ..... | + 0.2 | ..... | + 0.2 |
| Do | Sept. | ..... | + 0.2 | ..... | + 0.2 | ..... | + 0.1 |
| Eastport, Maine | Sept. | ..... | — 0.1 | ..... | — 0.1 | ..... | — 0.1 |
| Erie | Sept. | ..... | — 0.1 | ..... | 0.0 | ..... | — 0.1 |
| Escanaba | Aug. | ..... | + 0.2 | ..... | + 0.3 | ..... | + 0.3 |
| Do | Sept. | ..... | + 0.1 | ..... | + 0.3 | ..... | + 0.2 |
| Grand Haven | Aug. | ..... | + 0.1 | ..... | + 0.2 | ..... | — 0.2 |
| Do | Sept. | ..... | + 0.1 | ..... | + 0.1 | ..... | — 0.1 |
| Huron | Aug. | ..... | + 0.3 | ..... | — 0.3 | ..... | + 0.3 |
| Do | Sept. | ..... | + 0.1 | ..... | + 0.2 | ..... | + 0.1 |
| Indianapolis | Aug. | ..... | — 0.1 | ..... | + 0.1 | ..... | — 0.3 |
| Do | Sept. | ..... | 0.0 | ..... | 0.0 | ..... | — 0.2 |
| Keokuk | Aug. | ..... | — 0.1 | ..... | 0.0 | ..... | + 0.2 |
| Louisville | Aug. | ..... | + 0.2 | ..... | + 0.3 | ..... | 0.0 |
| Do | Sept. | ..... | + 0.2 | ..... | + 0.1 | ..... | + 0.3 |
| Marquette | Aug. | ..... | + 0.1 | ..... | + 0.2 | ..... | + 0.2 |
| Do | Sept. | ..... | + 0.2 | ..... | + 0.1 | ..... | + 0.3 |
| Milwaukee | Sept. | ..... | + 0.1 | ..... | — 0.1 | ..... | + 0.1 |
| New York | Aug. | — 0.1 | + 0.1 | + 0.2 | + 0.1 | 0.0 | — 0.1 |
| Do | Sept. | 0.0 | + 0.1 | + 0.3 | + 0.1 | 0.0 | 0.0 |
| Omaha | Aug. | ..... | + 0.2 | ..... | — 0.1 | ..... | + 0.1 |
| Do | Sept. | ..... | 0.0 | ..... | 0.0 | ..... | 0.0 |
| Olympia | Aug. | ..... | 0.0 | ..... | + 0.2 | ..... | + 0.2 |
| Do | Sept. | ..... | + 0.1 | ..... | + 0.1 | ..... | + 0.2 |
| Oswego | Aug. | ..... | + 0.2 | ..... | + 0.1 | ..... | + 0.1 |
| Do | Sept. | ..... | + 0.1 | ..... | + 0.1 | ..... | + 0.1 |
| Portland, Maine | Aug. | ..... | — 0.1 | ..... | + 0.2 | ..... | + 0.3 |
| Do | Sept. | ..... | — 0.2 | ..... | + 0.1 | ..... | 0.0 |
| Portland, Oregon | Sept. | ..... | + 0.2 | ..... | + 0.3 | ..... | + 0.3 |
| Philadelphia | Sept. | — 0.2 | — 0.2 | — 0.1 | — 0.2 | 0.0 | — 0.3 |
| Sacramento | Aug. | ..... | — 0.1 | ..... | + 0.1 | ..... | 0.0 |
| Do | Sept. | ..... | 0.0 | ..... | + 0.1 | ..... | 0.0 |
| San Francisco | Aug. | + 0.5 | + 0.5 | + 0.5 | + 0.6 | + 0.3 | + 0.6 |
| Santa Fé | Aug. | ..... | + 0.1 | ..... | + 0.3 | ..... | + 0.1 |
| Do | Sept. | ..... | + 0.1 | ..... | + 0.2 | ..... | + 0.1 |
| Saint Louis | Sept. | — 0.8 | — 0.4 | — 0.5 | — 0.6 | — 0.7 | — 0.6 |
| Saint Paul | Aug. | ..... | + 0.1 | ..... | 0.0 | ..... | + 0.1 |
| Do | Sept. | ..... | + 0.1 | ..... | + 0.1 | ..... | + 0.1 |
| Toledo | Aug. | ..... | + 0.2 | ..... | + 0.3 | ..... | + 0.1 |
| Do | Sept | ..... | + 0.1 | ..... | + 0.1 | ..... | + 0.2 |
| Valentine | Aug. | ..... | + 0.1 | ..... | + 0.1 | ..... | + 0.2 |
| Do | Sept. | ..... | — 0.1 | ..... | 0.0 | ..... | — 0.2 |
| Washington | Aug. | 0.0 | 0.0 | + 0.1 | + 0.2 | + 0.1 | + 0.1 |
| Do | Sept. | — 0.1 | — 0.1 | — 0.2 | 0.0 | 0.0 | + 0.1 |

In Table II are given the differences between the wet-bulb thermometers, still and whirled. The first column contains for each station the means of all differences where the wet-bulb reads from zero to three degrees lower than the dry-bulb; the second column the means where the wet-bulb reads from three to six degrees lower than the dry-bulb, and so on. The means are, in some cases, formed from as many as seventy results, and in others from not more than four.

On the average for all the stations the wet-bulb reads from 0° to 3° lower than the dry-bulb in 30 per cent. of the observations. The wet-bulb is from 3° to 6° lower in 28 per cent. of the observations. Wet-bulb 6° to 9° lower than dry-bulb comprises 17 per cent. of the observations; 9° to 12°, 10 per cent.; 12° to 15°, 7 per cent.; 15° to 18°, 5 per cent.; 18° to 21°, 2 per cent.; all others, with wet-bulb 21° or more lower than dry-bulb, 1 per cent.

TABLE II.—*Differences of still and whirled wet-bulb thermometers, in degrees Fahrenheit. August, September*, 1886.

[Plus sign indicates still reads higher than whirled.]

| Station. | Month. | Whirled wet-bulb lower than dry-bulb. 0° to 3°. | 3° to 6°. | 6° to 9°. | 9° to 12°. | 12° to 15°. | 15° to 18°. | 18° to 21°. | 21° to 24°. | 24° to 27°. | 27° to 30°. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| Albany | Aug. | +0.5 | +0.7 | +1.1 | +1.0 | +1.2 | +1.4 | +2.0 | ..... | ..... | ..... |
| Do | Sept. | +0.6 | +0.9 | +1.3 | +1.4 | ..... | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | +0.6 | +0.8 | +1.2 | +1.2 | +1.2 | +1.4 | +2.0 | ..... | ..... | ..... |
| Baltimore | Aug. | +0.3 | +0.4 | +0.3 | +0.3 | +0.4 | ..... | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.4 | +0.4 | +0.2 | +0.2 | +0.5 | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | +0.4 | +0.4 | +0.2 | +0.2 | +0.4 | ..... | ..... | ..... | ..... | ..... |
| Boston | Aug. | +0.4 | +1.0 | +0.8 | +0.9 | +1.3 | +1.8 | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.3 | +0.6 | +0.7 | +0.8 | +1.0 | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | +0.4 | +0.8 | +0.8 | +0.8 | +1.2 | +1.8 | ..... | ..... | ..... | ..... |
| Buffalo | Aug. | +0.4 | +0.8 | +0.7 | +2.0 | +2.4 | ..... | +4.0 | ..... | ..... | ..... |
| Do | Sept. | +0.5 | +1.1 | +1.8 | +2.2 | +3.1 | +3.0 | ..... | ..... | ..... | ..... |
| Means | ..... | +0.4 | +1.0 | +1.2 | +2.1 | +2.7 | +3.0 | +4.0 | ..... | ..... | ..... |
| Cedar Keys | Aug. | +0.4 | +0.5 | +0.5 | +0.0 | ..... | ..... | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.3 | +0.4 | +0.3 | +0.3 | +0.4 | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | +0.4 | +0.4 | +0.4 | +0.4 | +0.4 | ..... | ..... | ..... | ..... | ..... |
| Charleston | Aug. | 0.0 | —0.1 | +0.4 | +0.6 | +0.3 | ..... | ..... | ..... | ..... | ..... |
| Cincinnati | Aug. | +0.1 | +0.9 | +0.6 | +0.6 | +0.8 | +1.8 | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.2 | +0.5 | +0.4 | +0.5 | +0.5 | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | +0.2 | +0.7 | +0.5 | +0.6 | +0.6 | +1.8 | ..... | ..... | ..... | ..... |
| Chattanooga | Aug. | 0.0 | +0.1 | +0.4 | +1.7 | +0.7 | +0.5 | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.1 | +0.2 | 0.0 | —0.2 | 0.0 | +0.1 | ..... | ..... | ..... | ..... |
| Means | ..... | 0.0 | +0.2 | +0.2 | +0.8 | +0.4 | +0.3 | ..... | ..... | ..... | ..... |
| Cleveland | Aug. | +0.8 | +1.1 | +2.3 | +2.0 | ..... | +3.3 | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.6 | +1.2 | +2.3 | +3.3 | +1.5 | +4.8 | ..... | ..... | ..... | ..... |
| Means | ..... | +0.7 | +1.2 | +2.3 | +2.6 | +1.5 | +4.0 | ..... | ..... | ..... | ..... |
| Columbus | Aug. | +0.4 | +0.3 | +0.4 | 0.0 | +0.0 | +0.3 | +2.0 | ..... | ..... | ..... |
| Do | Sept. | +0.4 | +0.5 | +0.3 | +0.5 | +0.1 | —0.2 | ..... | ..... | ..... | ..... |
| Means | ..... | +0.4 | +0.4 | +0.4 | +0.3 | +0.4 | 0.0 | +2.0 | ..... | ..... | ..... |
| Davenport | Sept. | +0.6 | +0.9 | +1.2 | +1.3 | +1.4 | +1.2 | ..... | ..... | ..... | ..... |
| Denver | Aug. | +0.4 | +0.5 | +0.6 | +0.6 | +0.4 | +1.2 | +0.8 | +0.8 | +1.1 | +0.9 |
| Do | Sept. | +0.3 | +0.5 | +0.4 | +0.5 | +0.5 | +0.3 | +1.5 | +0.7 | +1.2 | ..... |
| Means | ..... | +0.4 | +0.5 | +0.5 | +0.6 | +0.4 | +0.8 | +1.2 | +0.8 | +1.2 | +0.9 |
| Eastport | Sept. | +0.4 | +1.0 | +1.1 | +1.6 | +1.3 | ..... | ..... | ..... | ..... | ..... |
| Erie | Sept. | +0.2 | +0.3 | +1.1 | +0.9 | ..... | ..... | ..... | ..... | ..... | ..... |
| Escanaba | Aug. | 0.0 | —0.1 | —0.1 | —0.1 | ..... | ..... | ..... | ..... | ..... | ..... |
| Do | Sept. | —0.1 | 0.0 | —0.1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | —0.1 | —0.1 | —0.1 | —0.1 | ..... | ..... | ..... | ..... | ..... | ..... |
| Grand Haven | Aug. | +0.7 | +1.0 | +1.4 | +1.8 | +1.6 | ..... | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.3 | +0.4 | +0.5 | +0.7 | ..... | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | +0.5 | +0.7 | +1.0 | +1.2 | +1.6 | ..... | ..... | ..... | ..... | ..... |
| Huron | Aug. | +0.4 | +0.4 | +1.3 | +0.2 | +0.3 | +1.8 | +4.7 | +5.0 | +5.0 | ..... |
| Do | Sept. | +0.2 | +0.9 | +1.1 | +1.4 | +2.9 | ..... | +3.4 | ..... | ..... | ..... |
| Means | ..... | +0.3 | +0.6 | +1.2 | +0.8 | +1.6 | +1.8 | +4.0 | +5.0 | +5.0 | ..... |
| Indianapolis | Aug. | +0.6 | +0.5 | +0.9 | +0.9 | +1.5 | +1.5 | +1.7 | ..... | ..... | ..... |
| Do | Sept. | +0.5 | +0.5 | +0.9 | ..... | +1.4 | +1.5 | ..... | ..... | ..... | ..... |
| Means | ..... | +0.5 | +0.5 | +0.9 | +0.9 | +1.4 | +1.5 | +1.7 | ..... | ..... | ..... |
| Keokuk | Aug. | ..... | +0.7 | +1.4 | +2.1 | +1.5 | +2.4 | +2.0 | ..... | ..... | ..... |
| Louisville | Aug. | +0.9 | +1.6 | +3.6 | +4.4 | +5.3 | +7.1 | +6.8 | ..... | ..... | ..... |
| Do | Sept. | +1.0 | +1.4 | +3.4 | +5.6 | +5.0 | +4.6 | ..... | ..... | ..... | ..... |
| Means | ..... | +1.0 | +1.5 | +3.5 | +5.0 | +5.0 | +5.8 | +6.8 | ..... | ..... | ..... |
| Marquette | Aug. | 0.0 | —0.2 | —0.6 | ..... | ..... | —2.4 | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.1 | —0.1 | —0.5 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | 0.0 | —0.2 | —0.6 | ..... | ..... | —2.4 | ..... | ..... | ..... | ..... |
| Milwaukee | Sept. | +0.3 | +0.7 | +0.7 | +0.7 | +0.4 | ..... | ..... | ..... | ..... | ..... |
| New York | Aug. | +0.5 | +0.6 | +0.9 | +0.8 | +1.1 | +1.4 | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.5 | +0.5 | +0.6 | +0.6 | +0.9 | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | +0.5 | +0.6 | +0.8 | +0.7 | +1.0 | +1.4 | ..... | ..... | ..... | ..... |
| Omaha | Aug. | +0.5 | +0.7 | +0.9 | +0.8 | +1.0 | +1.2 | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.9 | +1.1 | +0.9 | +1.0 | +1.1 | +1.2 | ..... | ..... | ..... | ..... |
| Means | ..... | +0.7 | +0.9 | +0.9 | +0.9 | +1.0 | +1.2 | ..... | ..... | ..... | ..... |
| Olympia | Aug. | +0.2 | +0.4 | +0.4 | +0.7 | ..... | ..... | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.3 | +0.3 | +0.5 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | +0.2 | +0.4 | +0.4 | +0.7 | ..... | ..... | ..... | ..... | ..... | ..... |
| Oswego | Aug. | +0.4 | +0.3 | +0.4 | +0.4 | +0.7 | ..... | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.5 | +0.5 | +0.5 | +0.8 | ..... | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | +0.4 | +0.4 | +0.4 | +0.6 | +0.7 | ..... | ..... | ..... | ..... | ..... |
| Portland, Me | Aug. | +0.6 | +1.6 | +2.4 | +2.3 | +2.4 | ..... | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.6 | +1.5 | +2.0 | +2.5 | ..... | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | +0.6 | +1.6 | +2.2 | +2.4 | +2.4 | ..... | ..... | ..... | ..... | ..... |
| Portland, Oreg | Sept. | +0.6 | +1.0 | +0.8 | +1.6 | +1.4 | ..... | ..... | ..... | ..... | ..... |
| Philadelphia | Sept. | +0.8 | +1.3 | +1.1 | +1.9 | +2.2 | +2.7 | ..... | ..... | ..... | ..... |
| Sacramento | Aug. | +0.3 | +0.4 | +0.5 | +0.6 | +1.0 | +0.6 | +0.7 | +0.6 | ..... | ..... |
| Do | Sept. | +0.3 | +0.4 | +0.4 | +0.3 | +0.5 | +0.6 | +1.1 | ..... | ..... | ..... |
| Means | ..... | +0.3 | +0.4 | +0.4 | +0.4 | +0.8 | +0.6 | +0.9 | +0.6 | ..... | ..... |
| San Francisco | Aug. | +0.6 | +0.4 | +0.5 | +0.2 | +0.2 | ..... | ..... | ..... | ..... | ..... |
| Santa Fé | Aug. | +0.1 | +0.5 | +0.9 | +1.1 | +1.6 | +1.9 | +3.1 | +2.6 | ..... | ..... |
| Do | Sept. | +0.7 | +0.8 | +1.0 | +1.0 | +1.4 | +1.9 | +2.7 | ..... | ..... | ..... |
| Means | ..... | +0.4 | +0.6 | +1.0 | +1.0 | +1.5 | +1.9 | +2.9 | +2.6 | ..... | ..... |
| Saint Louis | Aug. | +0.8 | +1.8 | +2.2 | +2.6 | +3.2 | +3.9 | +4.1 | +4.6 | +5.0 | ..... |
| Do | Sept. | +1.4 | +1.7 | +2.1 | +3.2 | +3.6 | +3.6 | ..... | +5.9 | ..... | ..... |
| Means | ..... | +1.1 | +1.8 | +2.2 | +2.9 | +3.4 | +3.8 | +4.1 | +5.2 | +5.0 | ..... |
| Saint Paul | Aug. | +0.7 | +1.4 | +2.4 | +2.7 | +3.3 | +3.0 | +7.1 | ..... | ..... | ..... |
| Do | Sept. | +0.2 | +0.2 | +0.7 | +0.2 | +1.9 | ..... | ..... | ..... | ..... | ..... |
| Means | ..... | +0.4 | +0.7 | +1.0 | +1.4 | +2.0 | +3.0 | +7.1 | ..... | ..... | ..... |

TABLE II.—*Differences of still and whirled wet-bulb thermometers*—Cont'd.

| Station | Month. | Whirled wet-bulb lower than dry-bulb. 0° to 3°. | 3° to 6°. | 6° to 9°. | 9° to 12°. | 12° to 15°. | 15° to 18°. | 18° to 21°. | 21° to 24°. | 24° to 27°. | 27° to 30°. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| Toledo | Aug. | +0.3 | +0.5 | +0.8 | +1.0 | +0.8 | +0.9 | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.4 | +0.6 | +0.8 | +1.4 | +1.1 | +1.2 | ..... | ..... | ..... | ..... |
| Means | ..... | +0.4 | +0.6 | +0.8 | +1.2 | +1.0 | +1.0 | ..... | ..... | ..... | ..... |
| Valentine | Aug. | +0.5 | +1.0 | +0.9 | +1.3 | +1.7 | +1.7 | +1.4 | +3.4 | +3.3 | +1.0 |
| Do | Sept. | +0.4 | +1.0 | +1.0 | +1.6 | +1.4 | +2.0 | +1.7 | +2.3 | +3.6 | +3.9 |
| Means | ..... | +0.4 | +1.0 | +1.0 | +1.4 | +1.6 | +1.8 | +1.6 | +2.8 | +3.4 | +1.0 |
| Washington | Aug. | +0.5 | +0.7 | +1.2 | +1.2 | +1.5 | ..... | ..... | ..... | ..... | ..... |
| Do | Sept. | +0.6 | +1.2 | +1.8 | +1.7 | +3.0 | +4.0 | ..... | ..... | ..... | ..... |
| Means | ..... | +0.6 | +1.0 | +1.5 | +1.4 | +2.2 | +4.0 | ..... | ..... | ..... | ..... |
| | | Percentage of observations. | | | | | | | | | |
| | | 30. | 28. | 17. | 10. | 7. | 5. | 3. | 1. | | |
| Mean of all | ..... | +0.4 | +0.7 | +0.9 | +1.2 | +1.4 | +1.9 | +3.1 | +3.1 | +3.9 | ..... |

The conclusions drawn from these results are:

1st. The whirled dry-bulb thermometer reads about the same as the still dry bulb. The small differences of the two, shown in Table I, are due in most cases to unavoidable error of observation. This speaks well for the form of shelter adopted by the Signal Service.

2d. The whirled wet bulb reads a good deal lower than the still wet bulb. The difference between the wet bulb "still" and wet bulb "whirled" is greater, the greater the difference between the wet bulb and dry bulb. With the wet bulb two degrees lower than the dry bulb, the whirled wet bulb is 0°.4 lower than the still wet bulb. When the wet bulb is twenty-six degrees lower than the dry bulb the whirled wet bulb reads about 4°.0 lower than the still wet bulb.

3d. The difference between the whirled and still wet-bulb thermometers depends chiefly on the thoroughness of ventilation of the shelter.

4th. From experiments made at the Signal Office in Washington it has been found that the difference between the still and whirled wet bulb depends to some extent on the way muslin is put on the bulb, the way in which the wicking is attached that carries the water to the muslin, and the size and shape of thermometer bulb. If the muslin cover of the bulb is continued around the stem for one inch above the bulb it makes the still thermometer read a few tenths of a degree, Fahr., lower than it otherwise would.

5th. The mean relative humidity for August for twenty stations, computed from the readings of the whirled psychrometer was found to be 70 per cent. With the still psychrometer observed at the same time the relative humidity found from the same tables was 74 per cent.

## The following is an extract from the October, 1886, report of the "Alabama Weather Service," P. H. Mell, jr., of the Agricultural and Mechanical College, Auburn, director:

The average precipitation was 2.58 inches below the normal.

The temperature has been comparatively uniform until the close of the month when there was a rapid fall on the last three or four days, forming ice. The temperature was 2°.1 below the normal.

*Summary.*

Mean temperature, 65°; highest temperature, 90°, at Mount Willing, on the 15th, and at Fayette, on the 14th; lowest temperature, 28°, at Gadsden, on the 30th; range of temperature, 62°; greatest monthly range of temperature, 61°, at Gadsden; least monthly range of temperature, 36°, at Selma; mean daily range, 18°.5; greatest daily range of temperature, 43°, at Eufaula, on the 31st; least daily range of temperature, 4°, at Valley Head, on the 25th.

Mean depth of rainfall, 0.58 inches; mean daily rainfall, 0.019; greatest depth of monthly rainfall, 1.50 inches, at Greensborough; least depth of monthly rainfall, 0.00 inches, at Auburn, Mount Willing, Bermuda, Eufaula, and Oswichee; greatest daily local rainfall, 1.14 inches, at Valley Head, on the 26th.

Average number of days on which rain fell, 2; average number of cloudy days, 3; average number of fair days, 8; average number of clear days, 20.

Warmest day, 14th; coldest days, 28th, 29th, 30th.

Prevailing directions of wind, east and northeast.

## The following is an extract from the October, 1886, "Weather Review of the Illinois State Weather Service," Col. Charles F. Mills, director; central office, Springfield:

*Temperature.*—The mean temperature of the state for the month, 56°.4, was 1°.9 above the normal for twelve years. The mean temperature of the northern division was 55°.9; of the central division, 56°.2, and of the southern division, 58°.8.

The temperature was generally above the normal, but six places reporting a departure below.

The greatest departures occurred as follows: Above the normal—Marengo, McHenry county, 3°.9; Chicago, Cook county, 3°.5; Oneida, Knox county, 3°.0; Peoria, Peoria county, 4°.1; Mattoon, Coles county, 3°.9; Saint Louis, Missouri, 3°.8; Richview, Washington county, 3°.5. Below the normal—Melvin, Ford county, 1°.2, and Palestine, Crawford county, 1°.5.

The highest temperature reported during the month, 90°, occurred at Fairfield, Wayne county, on the 13th, and the lowest, 25°, occurred at Aurora, Kane county, on the 2d. The highest temperature prevailed on the 13th, and the lowest on the 1st, and 28th to 30th. The absolute range of temperature for the state was 65°; for the northern division, 61°; for the central division, 59°, and for the southern division, 64°. The greatest daily range was 45°, at Pekin, Tazewell county, on the 22d, and the least daily range was 1°, at Fairfield, Wayne county, on the 26th. The mean daily range for the state was 19°.4; for the northern division, 15°.4, and for the central and southern divisions, 20°.1.

*Precipitation.*—The average precipitation of the state for the month was 1.03 inches; for the northern division, 1.88 inches; central division, 0.98 of an inch, and southern division, 0.54 of an inch. It was 2.73 inches below the October normal for the state; 1.95 inches below for the northern division; 2.67 inches below for the central division, and 3.29 inches below for the southern division.

The precipitation was below the October normal at each of the stations reporting, the departures ranging from 0.06 of an inch to 4.71 inches below.

The most marked departures are as follows: Watseka, Iroquois county, 3.02 inches; Springfield, Sangamon county, 3.32 inches; Pana, Christian county, 3.44 inches; Mattoon, Coles county, 3.84 inches; Griggsville, Bond county, 4.71 inches; Anna, Union county, 3.35 inches, and Golconda, Pope county, 3.69 inches.

The following heavy rainfalls (1 inch or more) were reported: Marengo, McHenry county, 1.22, on the 15th; Cedarville, Stephenson county, 2.50, on the 14th; Oneida, Knox county, 2 inches, on the 14th, and Camden, Schuyler county, 1.13, on the 23d.

From the 1st to the 13th no appreciable precipitation fell. General rains fell on the 13th, 14th, 20th, 23d, and local showers during the remainder of the month.

Inappreciable snowfall was reported at several stations on the 28th.

The greatest monthly precipitation reported was 3.55 inches, at Oneida, Knox county, and the least, inappreciable, at Summer, Lawrence county.

## The following meteorological summary and accompanying remarks are from the October, 1886, report of the "Indiana Weather Service," Prof. H. A. Huston, of Purdue University, Lafayette, director:

| Districts. | Temperature. Highest. | Lowest. | Monthly means. | Average precipitation. |
|---|---|---|---|---|
| | ° | ° | ° | *Inches.* |
| Northern counties | 86.0 | 29.0 | 53.8 | 1.33 |
| Central counties | 82.5 | 23.0 | 52.2 | 1.11 |
| Southern counties | 94.0 | 26.0 | 54.8 | 0.78 |
| State | 94.0 | 23.0 | 53.6 | 1.07 |

The mean temperature of the state for October, 1886, was 0°.1 below the mean of October for the past three years; 1°.6 below the mean of sixteen years at Indianapolis; 4° above the mean of thirty-one years at Logansport; 4° above the mean of twenty-one years at Vevay; 2°.6 above the mean of thirty-three years at Spiceland; 1°.2 above the mean of seven years at Mauzy; 5°.8 below the mean of nine years at Blue Lick; 2°.9 below the mean of five years at Worthington; 5° above the mean of seven years at Lafayette. The mean temperature of the various stations ranges from 3° above the average, at Logansport, to 6°.1 below, at Mauzy.

The mean precipitation of the state for October, 1886, was 1.27 inches below the mean for the past three years; 2.17 inches below the mean of sixteen years at Indianapolis; 1.66 inches below the mean of thirty-one years at Logansport; 1.58 inches below the mean of twenty-one years at Vevay; 1.20 inches below the mean of twenty-eight years at Spiceland; 2.20 inches below the mean of seven years at Mauzy; 2.31 inches below the mean of five years at Blue Lick; 2.34 inches below the mean of five years at Worthington; 1.88 inches below the mean of seven years at Lafayette. The precipitation at the various stations is below the average, greatest amount, 2.93 inches, at Worthington.

Fogs were reported on the 1st, 2d, 3d, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 16th, 20th, 22d, 25th, 28th, 29th, 30th, 31st.

The high wind of the 14th was prevalent throughout the state, reaching a maximum velocity of forty-eight miles per hour.

Killing frosts occurred on the 1st, 2d, 3d, 22d, 23d, 30th, 31st.

## The following is from the advance bulletin (October, 1886) of the "Iowa Weather Service," Dr. Gustavus Hinrichs, director; central station at Iowa City:

October, 1886, was very warm and extraordinarily fine, southerly winds and calms largely prevailing. The month was generally dry, the great total rainfall in middle-eastern Iowa being due to a single very heavy rain on the 13th and 14th.

The mean temperature of the air was 4°.5 above normal. This has been

equalled or slightly surpassed only four times (1884, 1882, 1867, 1841), and largely exceeded only twice (1879 and 1839) during the past forty-eight years. The middle decade was warmest, being 8° above normal; the first decade was 4°, and the third was 2° above normal.

The number of nights with frost was normal, mainly comprising the first and last days of the month.

No snow fell in Iowa during the month, except a very slight show of snow during the forenoon of the 25th, in the northwest of Iowa, namely from Kossuth and Sac county westward.

The sky was remarkably clear, with frequent haze. The total cloudiness was the smallest on record for this month, being only 24 per cent. At the central station no cloudy day occurred, and the number of clear days was sixteen. Only seven evenings of the month were not clear.

The total run of the wind was considerably below normal; fully two-thirds of the time the wind was southerly or calm. The most extended high winds occurred early on the 14th, especially in eastern Iowa.

The number of days with rainfall was low, generally three in the west and five in the east; hence the month was, on the whole, a very dry one. But the rainfall of the evening of the 13th and early morning of the 14th was very great in eastern Iowa, so that the total rainfall for this part of the state is considerably above normal. This rain storm brought over two inches of rain from Jasper to Clayton and Muscatine county, and gave over four inches in Delaware county.

In the state the total rainfall of October was less than one inch in the northwest down to a line drawn from Monona to Black Hawk county. It very rapidly increased eastward, exceeding four inches from Poweshiek to Clayton and Clinton counties, and reaching its highest amount, six inches, in Delaware county.

The most extended thunder-storm of the month occurred on the 23d, bringing the highest rainfall to southern Iowa, and light hail to a few localities. The great rain storm of the 13th was accompanied with thunder and lightning in northern Iowa only.

### The following is from the October, 1886, report of the "Minnesota Weather Service," Prof. Wm. W. Payne, Carleton College, Northfield, director:

The mean temperature for the state, as deduced from observations taken at seventeen stations, was 51°.4, which was 8°.7 above that of the corresponding month of 1885.

The month was well marked as regards the extremes in temperature, the maximum being 91°.0, at Spring Valley, on the 5th, and the minimum 10°.2, at Moorhead, on the 1st, thus making the range for the state 80°.8. The greatest monthly range for any station was 75°.0, at Spring Valley, while the least range was 52°.0, at Red Wing.

Fair weather characterized the month, the rain being very light in quantity and extending over but few days.

The mean rainfall was 1.42 inches, which was .50 inch above that of the corresponding month of 1885, but was below the average at places where records have been kept a number of years. At Saint Paul it was greatest, the deficiency being 1.33 inches, while at La Crosse it was .81 inch; Saint Vincent, .70 inch; Moorhead, .56 inch, and Duluth, .47 inch. The greatest amount which fell at any one place was 2.58 inches, at Red Wing; the least amount was .56 inch, at Mankato, which place had a fall of 6.07 inches, the month previous to that being the most for any station in the state. The heaviest precipitation occurred during thunder-storms of considerable severity on the 11th and 23d, 1.52 inches; the greatest daily amount falling on the latter date at Moorhead, while the next greatest daily fall was 1.04 inches, at Red Wing, on the 11th.

### The following is from the October, 1886, report of the "Mississippi Weather Service," Prof. R. B. Fulton, of the University of Mississippi, Oxford, director:

*Summary.*

Mean temperature, 64°; highest temperature, 95°, on 9th, at Lake; lowest temperature, 27°, on 28th, at Hernando; monthly range of temperature, 68°; greatest daily range of temperature, 42°, on 17th, at Macon; least daily range of temperature, 6°, on 29th, at Corinth, and 12th, at Mobile.

Mean monthly rainfall, .49 inch; greatest monthly rainfall, 1.75 inches, at Holly Springs; least monthly rainfall, .01 inch, at Brookhaven; average number of days' rainfall, 2; dates of frost, 2d, 4th, 17th, 28th, 29th, 30th, 31st.

* * * * * * * * *

During the month of October, by direction of the United States Signal Service, the following towns in Mississippi have been made cold-wave stations and receive telegraphic warnings when the temperature is likely to fall suddenly below 45°: Oxford, Grenada, Jackson, Crystal Springs, Natchez, Columbus, and Meridian.

Arrangements are being perfected by which, through the courtesy of railroad and telegraph companies, it is expected that the daily weather indications received from Washington can be transmitted to all important towns in the state.

### The following is an extract from the October, 1886, report of the "Missouri Weather Service," Prof. Francis E. Nipher, Washington University, Saint Louis, director:

The temperature of October has been 61°.2, which is 5° above the normal temperature for October. The highest temperature observed was 82° on the 13th, the daily maximum rising to or above 80° five times during the month. The coldest temperature was 36.1 on the morning of the 28th. The air temperature did not fall to the freezing point of water, although in former years it has been known to do so as early as October 4th (in 1836) and has fallen during the month as low as 19°.5 (on October 31, 1863).

The month was fair and pleasant throughout, the middle decade being the warmest of the three. The average temperature of the decades was 62°.2, 67°.2, and 58°.8.

The rainfall of the month was 0.95 inch, 0.84 inch of which fell during half an hour on the 20th. The normal rainfall for October is three inches.

In the state the rainfall has been light. In the southern and southeastern part, with the exception of a small area near Ironton, the fall has been less than one inch. North of this is a belt where the fall was from one to two inches. In the extreme northwest the maximum rainfall of over three inches occurred.

The lowest temperatures reported are 21° at Mound City and 23° at Ironton; the highest are 88° at Pro Tem on the 12th and 88° at Greenfield on the 11th, 12th, and 13th.

As a rule the maximum temperatures throughout the state occurred on or about the 12th, and the minimum on or about the 28th day of the month. Heavy frosts reported from all parts, fourteen stations out of twenty reporting a minimum of below 32° Fahr.

### The following is from the October, 1886, report of the "Nebraska Weather Service," Prof. Goodwin D. Swezey, of Doane College, Crete, director:

The weather for October has been warm, dry, clear, and with greater extremes than usual, both of cold and heat.

Two storms of some severity have been felt in eastern Nebraska. The first came from the Northwest on the 13th, and united with one from the Gulf region (the same that caused the severe gales and floods in Louisiana on the 12th and 13th), forming a storm area, extending throughout the Mississippi Valley, central in Iowa. This brought rain in eastern Nebraska, and the lowest barometer of the month. A second storm passed on the 22d and 23d.

The temperature for the month was about three degrees above the normal, being the warmest October since 1879. The rainfall was less than for any October since 1878, being about half the normal amount.

### The following summary for October, 1886, is from the "Bulletin of the New England Meteorological Society," Prof. Wm. H. Niles, of Boston, Massachusetts, President:

*Summary for October*, 1886.

Reports for the month were received from one hundred and forty-eight observers. The temperature of the month runs a little above the mean of October for other years; the rainfall would have been very deficient, but for continued storminess of the last six days of the month, which brought the total precipitation up toward the normal.

The weather experienced may be described under four periods.

*First period.*—Fair from 1st to 11th; the clearing off of the last storm of September gave hail at noon at Quincy, New Hampshire, and a northwest squall at 15.30* at Gardiner, Maine, followed by cool weather and northwesterly winds, with frosts and ice almost down to the southern coast, up to the 4th or 5th; Nantucket had its first frost on the 2d. On the 4th an area of moderate pressure crossed Canada, giving light rain at several northern stations (Burlington, Vermont, from 16h. to 23h.; Newport, Vermont, 16h. to 18h.; Lunenburg, Vermont, after 21h.; Mayfield, Maine, at night); solar and lunar halos were observed apparently in connection with the upper clouds of this storm at a number of stations even down to the southern coast from the 4th to the 7th, but on account of the unequal attention given to these phenomena by different observers, records of them cannot be well discussed; absence of record cannot be taken as implying absence of halos. Frosts were again noted at several interior stations on the 6th or 7th, and fair weather with warm days (73° to 84° on the 9th) and cool nights under high atmospheric pressure prevailed throughout until the 11th.

The diurnal range of temperature during the passage of high pressure areas in the earlier and later divisions of this period ran as follows: northern interior, 35° to 40°; southern interior, 25° to 35°; coast, 15° to 20°; islands, 10° to 20°. On the 3d and 8th the minimum temperature at the base of Blue Hill (elevation 200 feet) was more than seven degrees lower than the minimum on the summit (635 feet), showing the vertical inversion of temperature characteristic of quiet, clear air at night; this anomalous condition probably prevailed all over New England.

*Second period.*—Variable from 12th to 18th; high temperature (75° to 82°) preceded a light general rain which fell, except in Connecticut, on the afternoon and night of the 12th and early hours of the 13th, beginning at 15h. to 16h. in the northwest, and at 19h. to 22h. in the southeast; this was in a trough of moderate pressure between anti-cyclonic areas north and south. General rain fell again on the evening and night of the 14–15th, in connection with the passage of a cyclonic area which was well-defined on the Lakes, but which passed far north of New England, and gave us less rain and wind than was expected; the rain began at 18h.–19h. in the west, at 20h. to 23h., in the east, and ended during the night or early on the 15th; high winds, generally northwest, were reported on the 15th and 16th, and on the 16th

*Hours are counted from midnight to midnight; 15.30 being 3.30 p. m.

snow-squalls were frequent at the northern interior stations, followed by the coldest night of the month, giving minima on the morning of the 17th below 15° in the north (Jacksonville, Vermont, 10°; Berlin Mills, New Hampshire, 13°; New Bedford, Massachusetts, 24°; Nantucket, Massachusetts, 34°). This was again followed by light rain in a trough of low pressure at nearly all but the northern stations about midnight of the 17–18th; several solar halos were noticed before and after this rain. The diurnal range during this period was of less value than before, being seldom over 30°, and often under 10°, so that the contrast between coast and interior was much reduced.

*Third period.*—Fair from 18th to 24th, excepting a light rain at the western and northern stations about 6h. to 10h. on the 21st, attending the passage of a distinctly cyclonic area over Canada; this period was characterized by high pressure and pleasant weather, with clear or fair and mild days, and cool, often frosty nights. The instruments at the top and bottom of Blue Hill again showed a temperature inversion of more than 7° on the 20th, and at Berlin Mills, a valley station in northern New Hampshire, the diurnal range on the 19th and 20th was 47° and 52°.

*Fourth period.*—Cloudy and rainy from 25th to 31st; this period opened with general cloudiness attending the passage of cyclonic area over Canada, giving light rains to northern stations about 6h. to 11h. An area of high pressure in the west (Wisconsin, 30.70 inches) then suggested that fair weather might be expected, but on the afternoon or evening of the 26th, rain began at nearly all stations, with northeast wind, under the control of a cyclonic storm that was first seen off the Carolina coast, and these unpleasant conditions prevailed during the rest of the month as the storm moved slowly northeastward. Hail fell in Maine on the 27th (Lewiston, 5.30; Gardiner, 6.45), and lightning and thunder were noted at several stations in the evening of the 30th or early on the 31st, when clear sky appeared at some points for a brief interval. Fair weather was not established till November 1st. Under the cover of the clouds and in the presence of the chilly northeast wind, the diurnal range of this period was seldom more than 20°, and was commonly less than 10° or even less than 5°; little contrast could then be found between the coast and the interior in this respect.

**The following is from the October, 1886, report of the "Ohio Meteorological Bureau," Prof. B. F. Thomas, director; central office, Ohio State University, Columbus:**

The month just closed was unusually pleasant. It was marked by high barometer, average temperature, small rainfall, and clear sky. Only two general rains occurred—one on the 13th, the other on the 28th and 29th.

The mean barometric height was 30.195 inches, .082 inch above the four-year average.

The mean temperature was 53°.2, which was the average of the last three years. The normal temperature for October is 52°.34.

The temperature range for the month was lower than on preceding years, because the minimum, 28°, was higher than usual, the figures for the preceding years being 25°, 18°, and 14°. The clear skies were responsible for an increased daily range of 22°.9, which is the highest daily range for the four years.

More than half the days were reported as clear, and only 6.4 were marked cloudy. The mean rainfall was only 1.27 inches. The four-year average is 2.78 inches, and the normal 2.73. The greatest rainfall was 2.30 inches, at Sidney, and the least, .47 inches, at Cleveland.

*Summary.*

Mean temperature, 53°.2; highest temperature, 87°.0, on the 13th, at Georgetown; lowest temperature, 28°.0, on the 2d and 3d, at Findlay and Youngstown; range of temperature, 59°.0; mean daily range of temperature, 22°.9; greatest daily range of temperature, 43°.0, on the 13th, at Logan; least daily range of temperature, 2°.5, on the 28th, at Greenville.

Average number of clear days, 16.8; average number of fair days, 7.8; average number of cloudy days, 6.4; average number of days on which rain fell, 5.7.

Mean monthly rainfall, 1.27 inches; mean daily rainfall, .041 inch; greatest number of days on which rain fell, 11, at Hiram; least number of days on which rain fell, 3, at several places; greatest rainfall, 2.30 inches, at Sidney; least rainfall, .47 inches, signal office at Cleveland.

Prevailing direction of wind, southwest.

**The following is an extract from the "Tennessee State Board of Health Bulletin" for October, 1886, prepared under the direction of J. D. Plunkett, M. D., President of the State Board of Health. The weather report is prepared by H. C. Bate, in charge of the State Meteorological Service:**

The month of October was remarkable for the small amount of rainfall, and the small percentage of cloudiness, also for the absence of any great amount of electrical disturbances. Altogether the month was very pleasant. It was ushered in with a slight cold wave, resulting in a frost on the night of the 1st.

The mean temperature was 57°.1, nearly three degrees above the mean of October last year, and more than six degrees below that of the corresponding period in 1884. The highest temperature was 88°, recorded on the 11th, and was three degrees above the highest recorded in October of last year, and eleven degrees lower than the highest recorded in October of the previous year. The lowest temperature was 22°, recorded on the 28th and 31st, and was respectively four degrees above and below the lowest of October, 1884 and 1885. The mean daily range of temperature was greater than in October of any of the three preceding years.

The mean depth of rainfall for the month was only 0.97 inch, and is probably by far the smallest amount ever recorded for the month in the state. It is 2.76 inches less than the October mean of last year, 1.29 inches less than that of 1884, and 4.27 inches less than that of 1883. Of the rain that fell during the month, the eastern division received a very large proportion, or an average of nearly one and three-fourths inches; the middle division received an average of less than half an inch, and the western division an average of a little more than half an inch. The greatest rainfall was 3.09 inches, reported at Greenville, and the smallest, 0.20 inch, reported at Covington. The greatest local daily rainfall was 2.05 inches, reported also at Greenville, on the 14th. Other heavy local rains were reported from the eastern division: Andersonville reports 1.16 inches, on the 25th; Jonesborough reports 1.30 inches, on the 26th; Careyville, 1.00 inch, on the 26th; Grief, 1.08 inches, on the 26th; and Fostoria, 1.01 inches, on the 24th. Most of the rains during the month were very light. The days of the greatest rainfall were the 13th, 14th, 25th, and 26th, and of these the heaviest rain was on the 14th, which was the most general rain of the month, the others being confined to the divisions. About twenty days of the month were reported without rain. Dews were reported on about twenty days during the month.

*State summary.*

Mean temperature, 57°.1; highest temperature, 88°, on the the 11th, at Covington; lowest temperature, 26°, on the 28th, at Hohenwald, and on the 31st, at Farmingdale; range of temperature, 62°; mean monthly range of temperature, 50°.5; greatest monthly range of temperature, 57°, at Howell and Sailor's Rest; least monthly range of temperature, 40°, at Greeneville and Careyville; mean daily range of temperature, 22°.9; greatest daily range of temperature, 42°, on the 23d, at Beech Grove, and on the 24th, at Rogersville; least daily range of temperature, 2°, on the 26th, at Jonesborough, and on the 28th, at Greeneville; mean of maximum temperatures, 82°.7; mean of minimum temperatures, 31°.8.

Average number of clear days, 22; average number of fair days, 4.5; average number of cloudy days, 4.5; average number of days on which rain fell, 8.

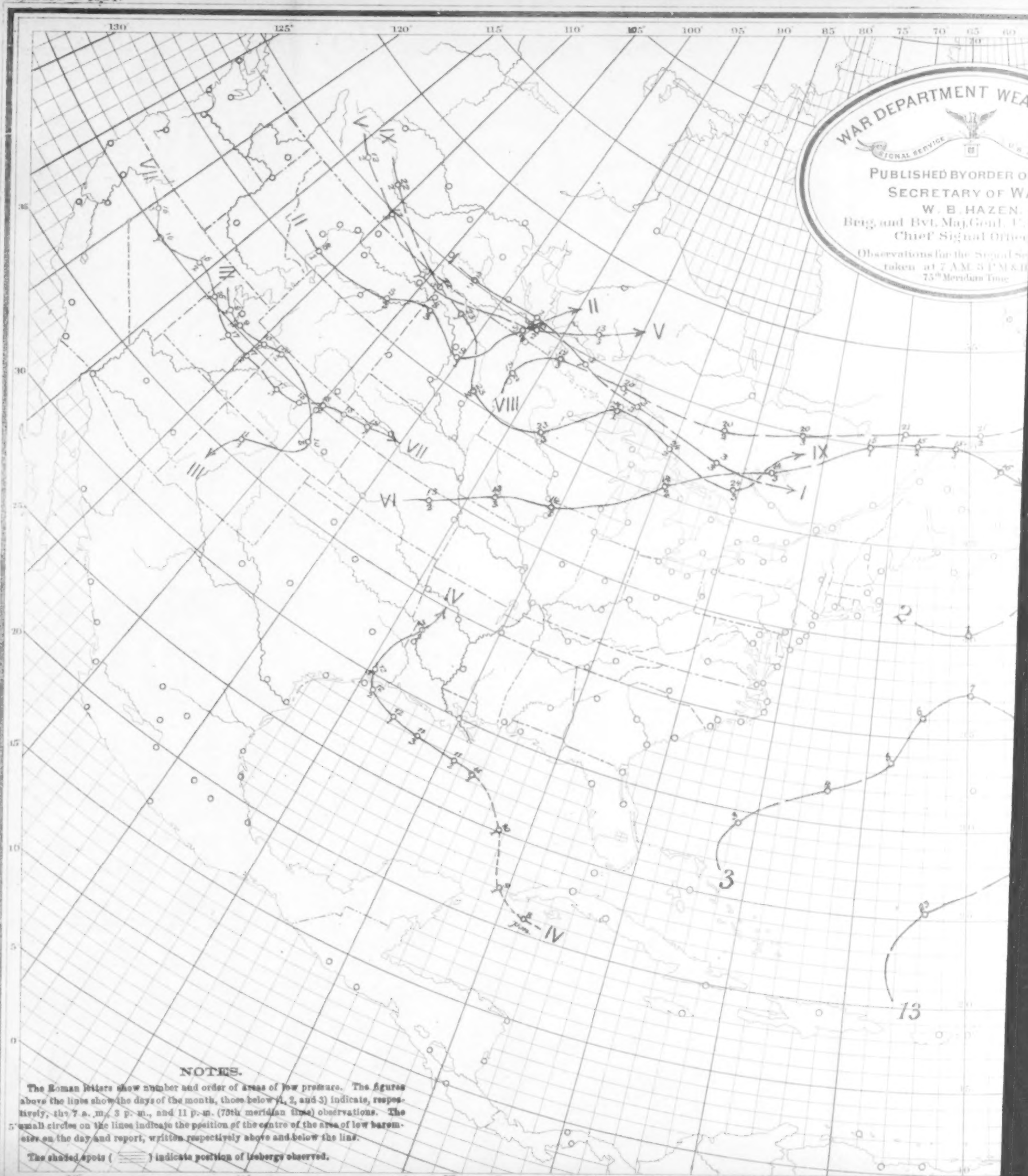
Mean depth of rainfall, 0.97 inch; mean daily rainfall, 0.031 inch; greatest rainfall, 3.09 inches, at Greeneville; least rainfall, 0.20 inch, at Covington; greatest local daily rainfall, 2.05 inches, on the 14th at Greeneville; days of greatest rainfall, 14th, 25th, 26th; day of greatest rainfall, 14th; days without rainfall, all, except 13th, 14th, 17th, 21st, 23d, 24th, 25th, 26th, 27th, 28th, 29th.

Warmest days, 11th, 13th; coldest days, 28th, 31st.

Prevailing winds, north and northwest.

Form 106 G 1884.

# Chart I. Tracks of Areas of Low Pres

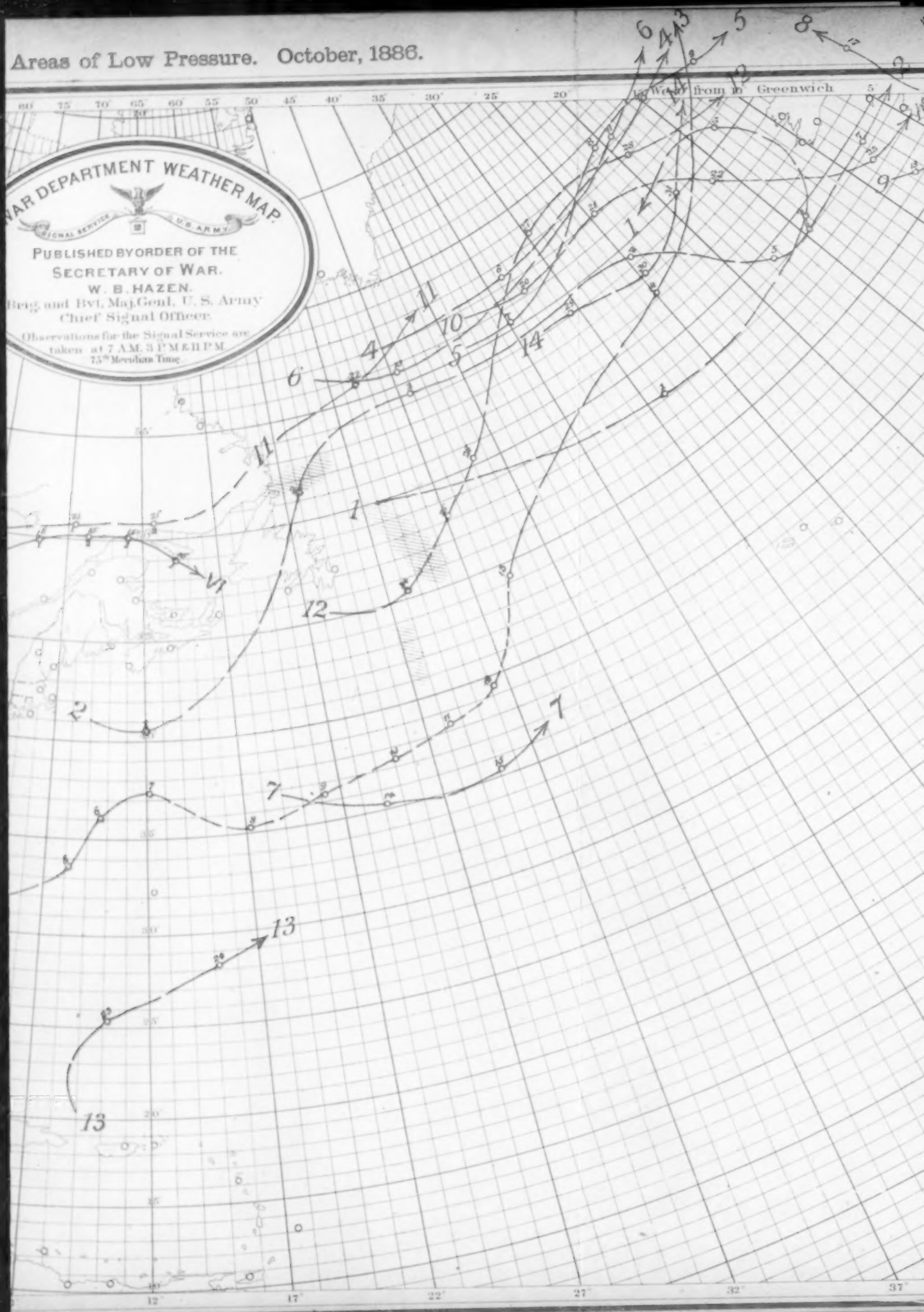



## NOTES.

The Roman letters show number and order of areas of low pressure. The figures above the lines show the days of the month, those below (1, 2, and 3) indicate, respectively, the 7 a. m., 3 p. m., and 11 p. m. (75th meridian time) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

The shaded spots ( ) indicate position of icebergs observed.

# Areas of Low Pressure. October, 1886.


NAR DEPARTMENT WEATHER MAP.
SIGNAL SERVICE U.S. ARMY
PUBLISHED BY ORDER OF THE
SECRETARY OF WAR.
W. B. HAZEN.
Brig. and Bvt. Maj. Genl. U. S. Army
Chief Signal Officer.
Observations for the Signal Service are taken at 7 A.M. 3 P.M. & 11 P.M.
75th Meridian Time.
Warsaw from m Greenwich
80 75 70 65 60 55 50 45 40 35 30 25 20
12 17 22 27 32 37

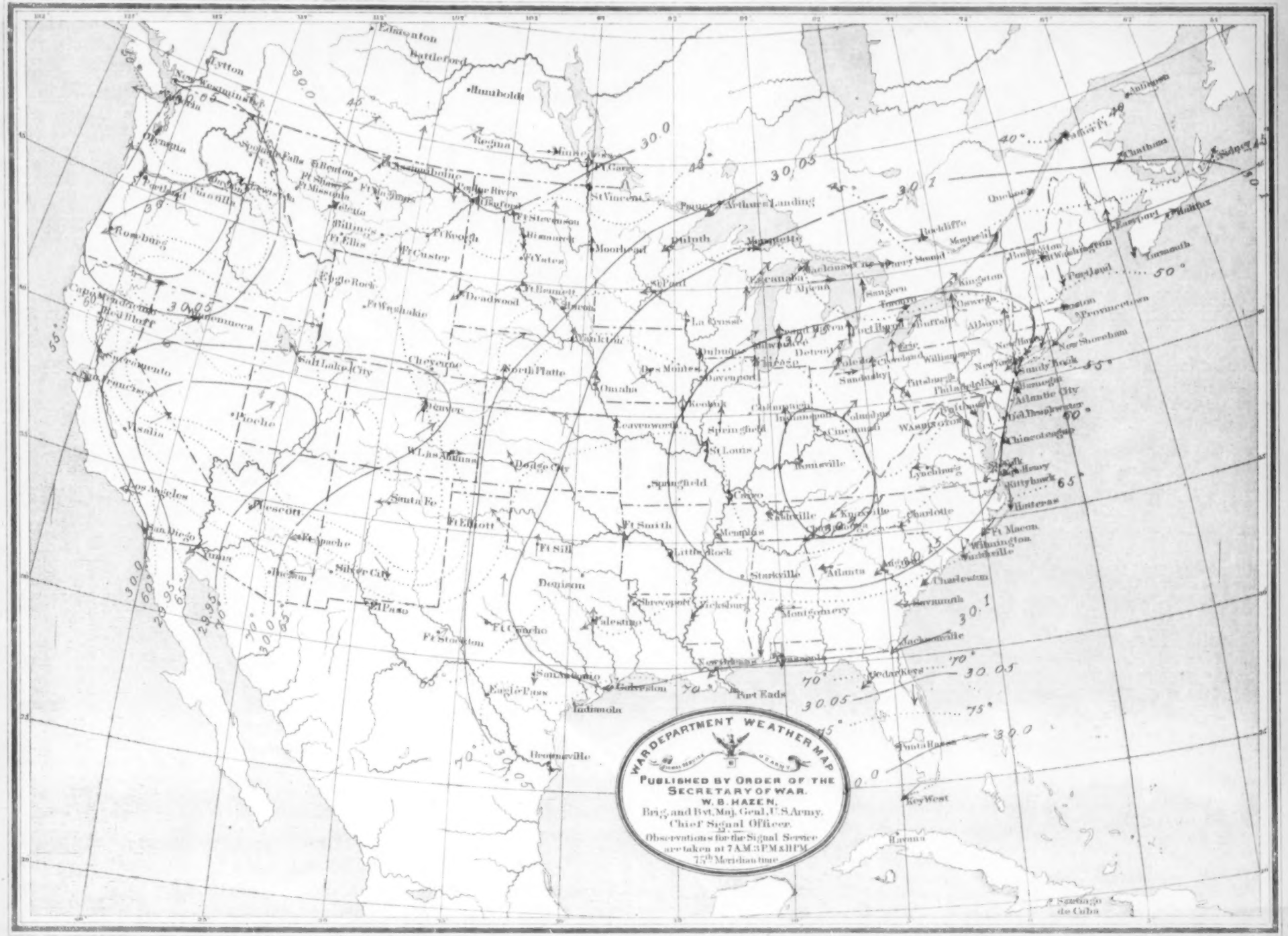
35
30
25
20
15
10
5
0
5'
37°
42°

Form 106 F

Chart II. Isobars, Isotherms, and Winds. October, 1886.

Form 106 F.

# Chart II. Isobars, Isotherms, and Winds. October, 1886.



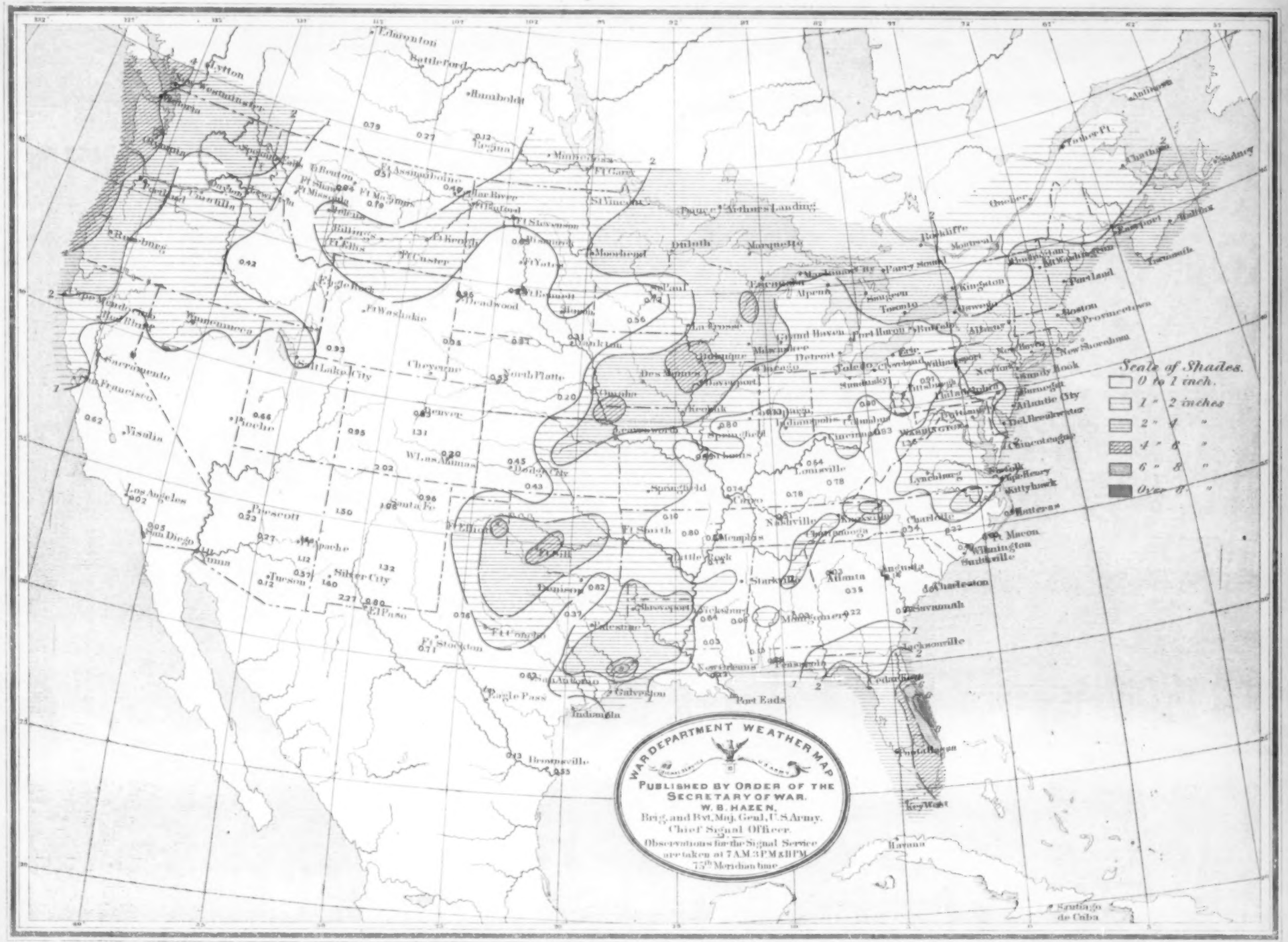

Signal Office Lith.

Form 106 F.

Chart III. Precipitation, October 1886.

Form 106 F

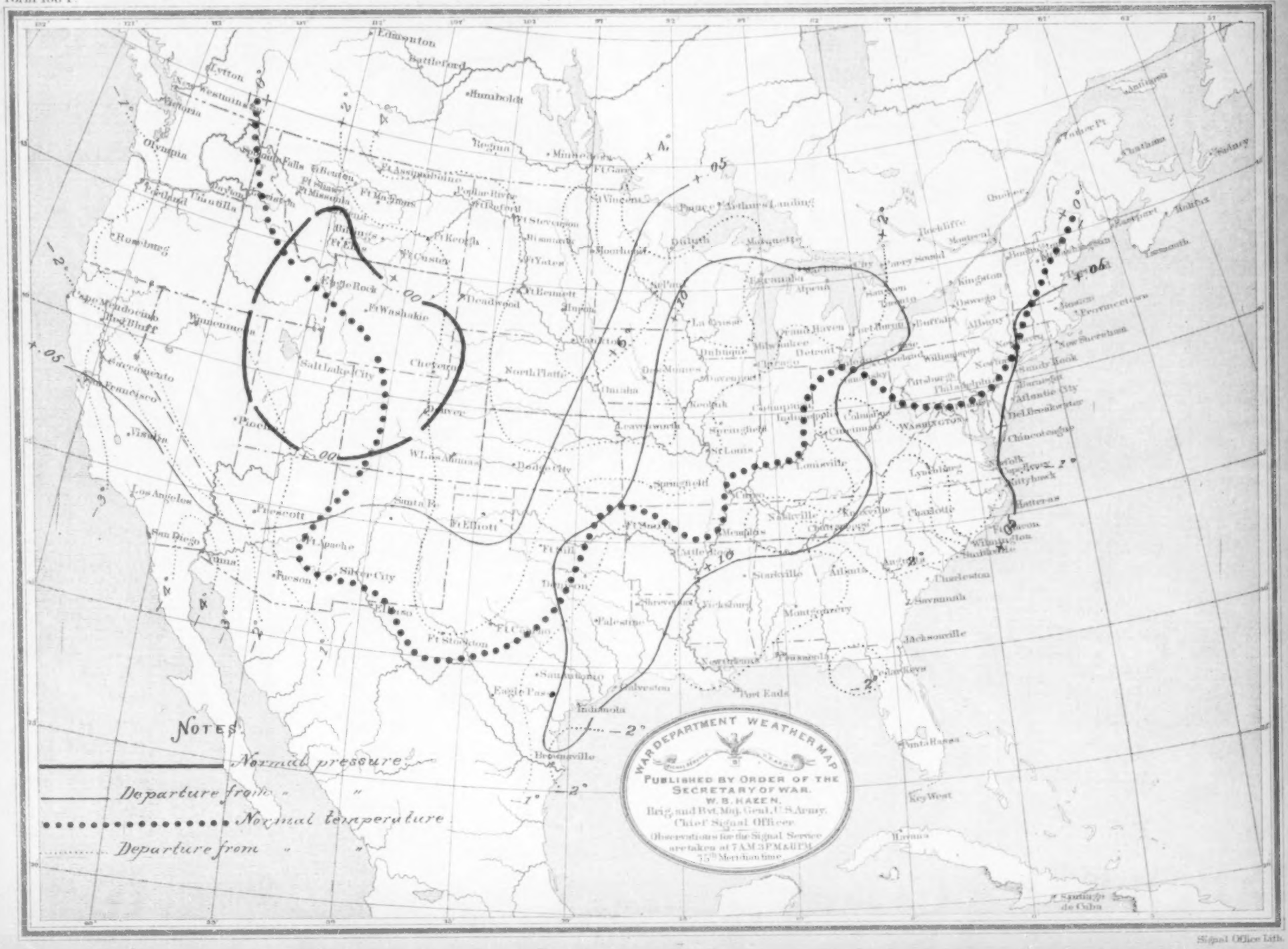
# Chart III. Precipitation, October; 1886.


Scale of Shades.
0 to 1 inch.
1 " 2 inches
2 " 4 "
4 " 6 "
6 " 8 "
Over 8 "
WAR DEPARTMENT WEATHER MAP
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.
W. B. HAZEN,
Brig. and Bvt. Maj. Genl. U.S. Army.
Chief Signal Officer.
Observations in the Signal Service are taken at 7 A.M. 3 P.M. & 11 P.M.
75th Meridian time.

Signal Office Lith.

Form 106 F.

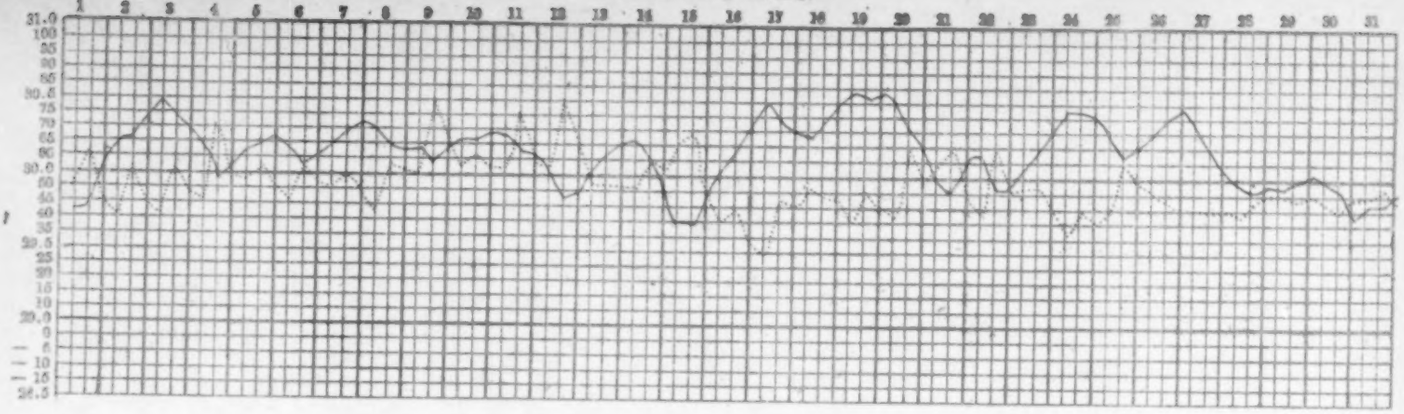
# Chart IV. Departures from Normal Atmospheric Pressure and Temperature. October, 1886.


NOTES.
Normal pressure
Departure from " "
Normal temperature
Departure from " "
WAR DEPARTMENT WEATHER MAP
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.
W. B. HAZEN,
Brig. and Bvt. Maj. Genl. U.S. Army,
Chief Signal Officer.
Observations for the Signal Service are taken at 7 A.M. 3 P.M. & 11 P.M. 75th Meridian time.

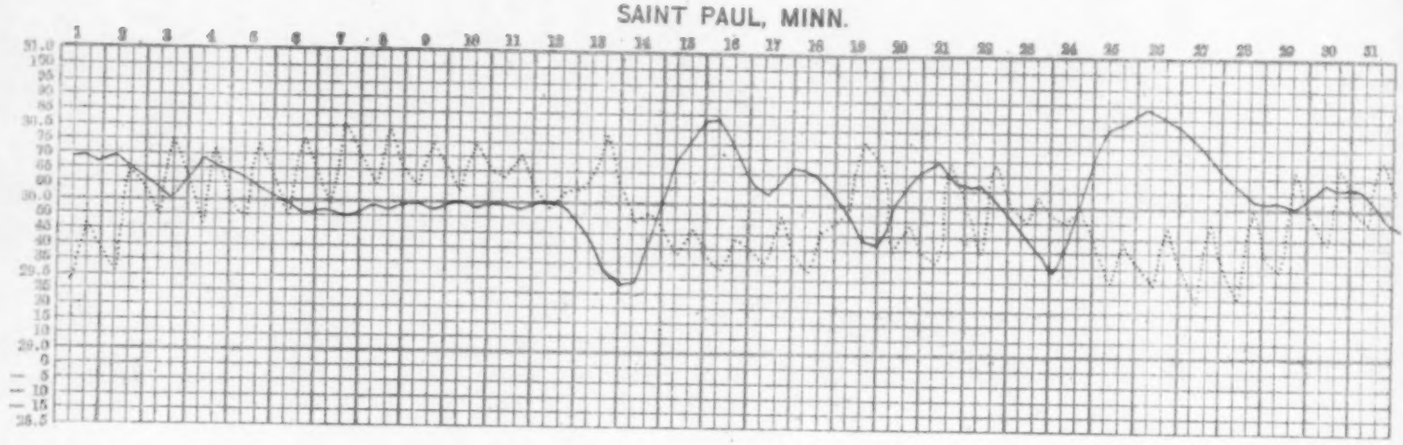
Signal Office Lith.

**Chart V.** Pressure (————) and Temperature (·····) Curves. October, 1886.

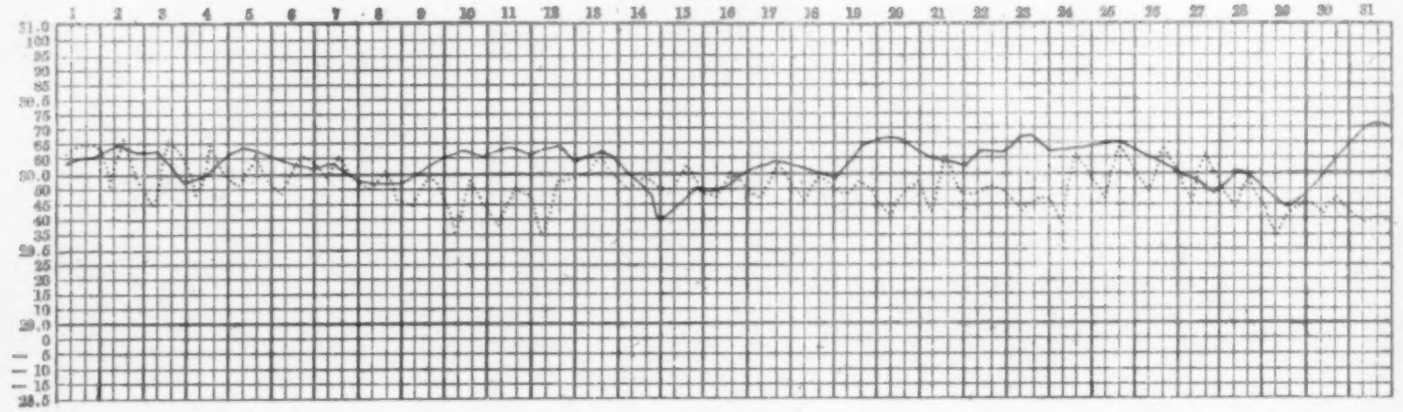
BOSTON, MASS.



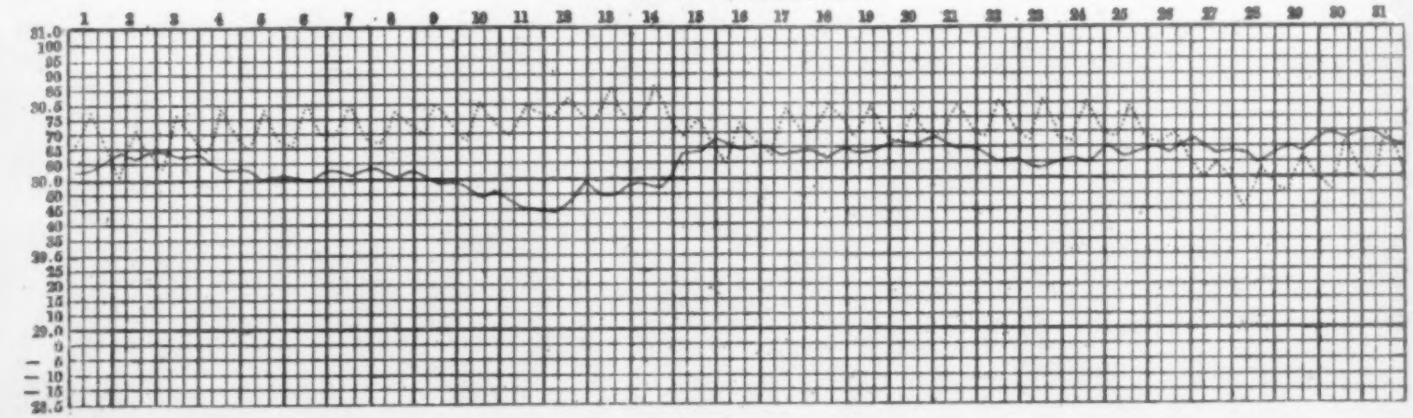
SAINT PAUL, MINN.



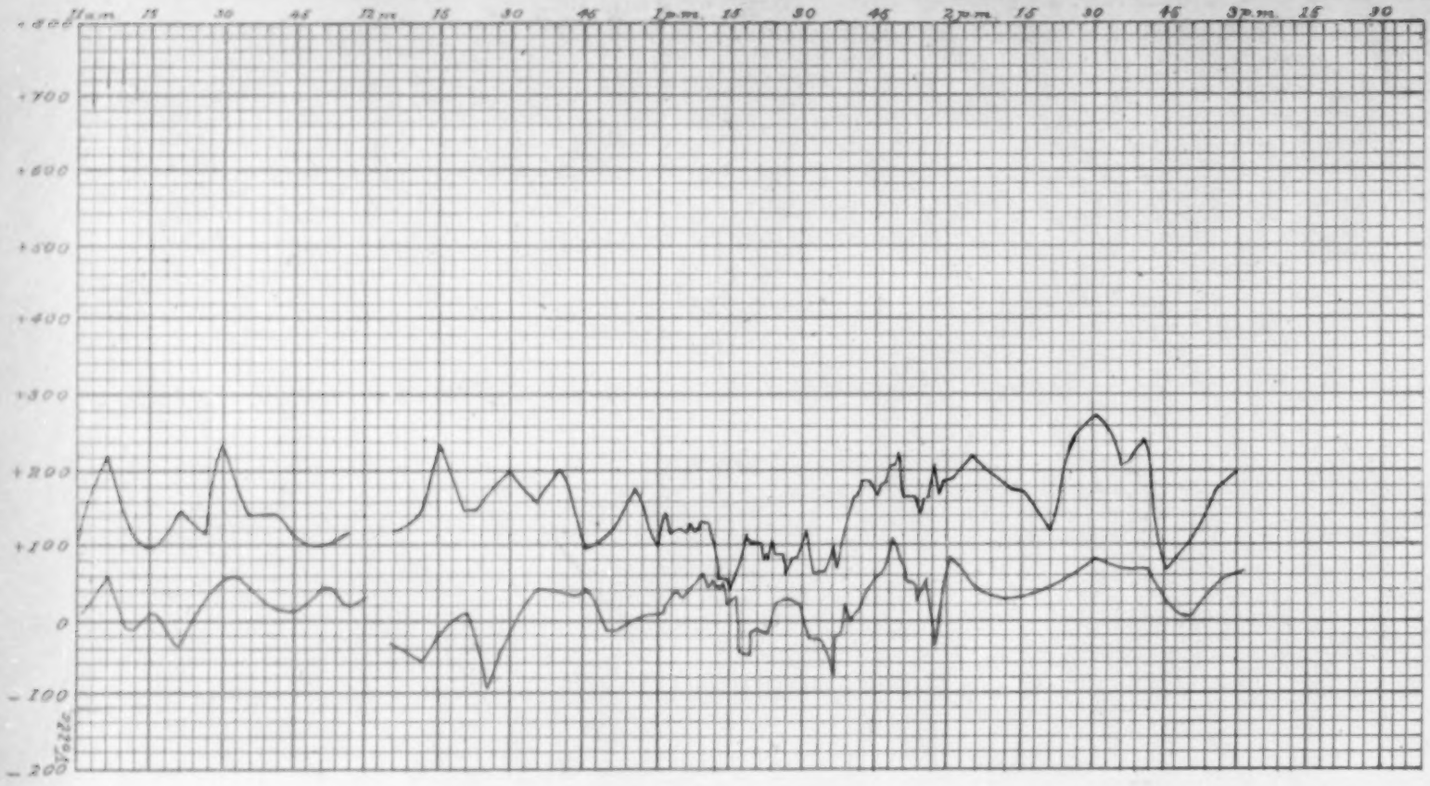
PORTLAND, OREG.



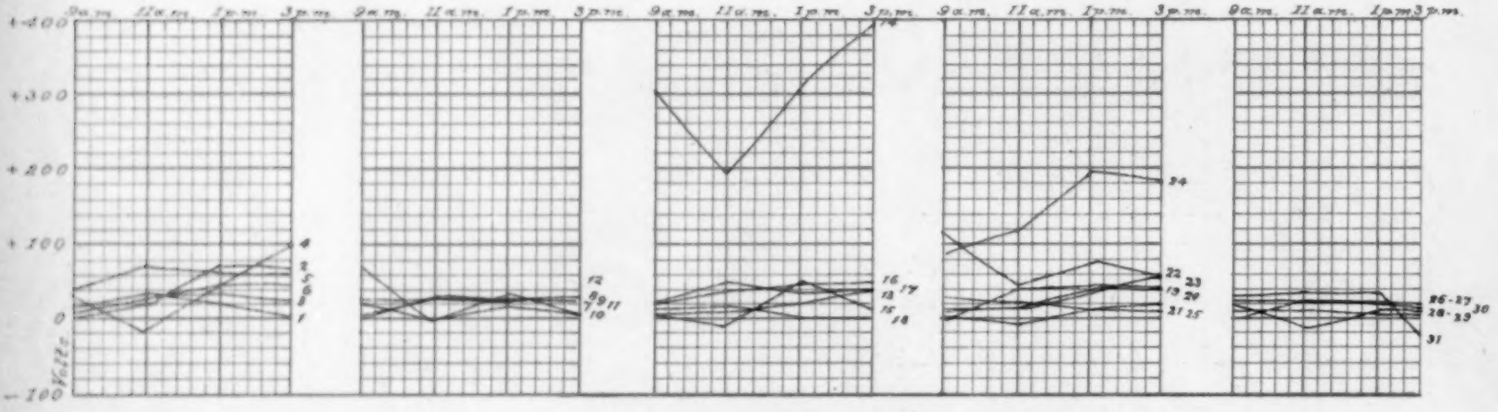
NEW ORLEANS, LA.



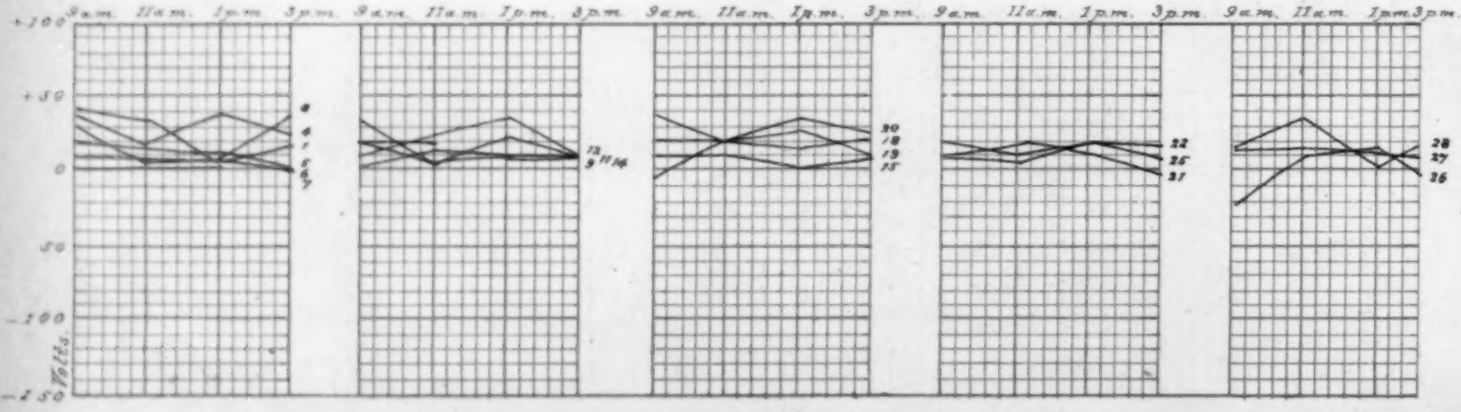
## Chart VI. Curves showing Electrometer Readings.




October 14, 1886. { Monument 500 feet. ——— Signal Office 45 feet. ———




Boston, Mass., October, 1886.




New Haven, Conn., October, 1886.

*Voluntary observers of the Signal Service, on land, from whom meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for October, 1886.*

*Observer and place of observation.*

Anderson, Dr. W. W., Stateburg, S. C.
Altaffer, J. M., Independence, Kans.
Adams, Dr. O. H., Vineland, N. J.
Abbott, Dr. E. K., Salinas, Cal.
Arents, Hiram, Oroville, Cal.
Adams, A. H., Fort Meade, Fla.
Avey, O. H., Oskaloosa, Iowa.
Beans, Thos. J. Moorestown, N. J.
Bushnell, W. S., Monticello, Ind.
Bentley, David, Princeton, Cal.
Boerner, Prof. Chas. G., Vevay, Ind.
Boynton, John F., Syracuse, N. Y.
Bayerly, J. F., Spartanburg, S. C.
Ballou, Dr. N. E., Sandwich, Ill.
Bennett, Geo., Bandon, Oreg.
Bell, Joseph, Franklin, Pa.
Beloit College Observatory, Beloit, Wis.
Baker, Dr. Henry B., Lansing, Mich.
Beall, Dr. R. L., Lenoir, N. C.
Brendel, Dr. Fred., Peoria, Ill.
Bartlett, E. B., Vermillion, N. Y.
Briggs, John, Albany, Oreg.
Betts, Prof. Arthur, Webster, Dak.
Breed, J. E., Embarras, Wis.
Baldwin, A. L., Bethel, Conn.
Boies, Lieut. A. H., Hudson, Mich.
Broberg, Mrs. Mary W., Manatee, Fla.
Black, W. H., Kalamazoo, Mich.
Blachly, C. P., Manhattan, Kans.
Bridges, Q. A., Berlin Mills, N. H.
Beecher, Chas., Wysox, Pa.
Bowman, Peter, Ruggles, Ohio.
Calhoun, P. B., Austin, Tenn.
Cook, S. A., Milledgeville, Ga.
Carrington, G. D., Brownville, Nebr.
Clark, T. A., Wausau, Wis.
Charbonnier, Prof. L. H., Athens, Ga.
Casey, Geo., Auburn, N. Y.
Crawford, E. A., Liberty Hill, La.
Curtiss, G. G., Fallston, Md.
Cornell University, Ithaca, N. Y.
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Cleveland, Dr. G. H., Pentwater, Mich.
Collie, G. L., Delevan, Wis.
Cotton, Dr. D. B., Portsmouth, Ohio.
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Chapin, Adams, Poway, Cal.
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Dechant, W. H., Mahanoy Plane, Pa.
Dunlap, W. L., Tecumseh, Nebr.
Dudley, C. B., Altoona, Pa.
Dazey, J. B., Charleston, Ill.

*Observer and place of observation.*

Deming, H. D., Wellsborough, Pa.
Dozier, Wm., Mattoon, Ill.
Dewhurst, Rev. E., Voluntown, Conn.
Day, Theodore, Dyberry, Pa.
Dawson, Wm., Spiceland, Ind.
Ellsworth, W. W., Hartford, Conn.
Eliason, W. A., Statesville, N. C.
Ellis, John, Marquette, Nebr.
Ewell, Dr. M. D., South Evanston, Ill.
Ford, H. C., El Dorado, Kans.
Fouch, Dr. A., Anderson, Cal.
Fitch, Dr. H. L., Urbana, Iowa.
Ferris, B. F., Sunman, Ind.
Friend, Chas. W., Carson City, Nev.
Fleming, J., Readington, N. J.
Fernald, Prof. M. C., Orono, Me.
Foss, E. T., Hydesville, Cal.
Fuller, Edw. N., Tacoma, Wash. T.
Featherton, Wm., Globe, Kans.
Field, T. G., Parkersburgh, W. Va.
Gibson, J. H., Salina, Kans.
Gore, Prof. J. W., Chapel Hill, N. C.
Gray, F. R., Yates Centre, Kans.
Gates, W. B., Burlington, Vt.
Graves, A. B., Belleville, Kans.
Gillingham, Milnor, Fallsington, Pa.
Gowey, H. D., North Lewisburg, Ohio.
Green, Dr. Jesse C., West Chester, Pa.
Gerrish, S. H., Sacramento, Cal.
Gray, J. W., Stockham, Nebr.
Goodwin, Wm., North Colebrook, Conn.
Goodspeed, Chas. W., Elyria, Ohio.
Gillingham, W., Accotink, Va.
Garlick, Rev. Dr. J. R., Bruington, Va.
Gray, Capt. A. W., Kenewick, Wash. T.
Grathwohl, John, Blooming Grove, Pa.
Heath, E. R., Wyandotte, Kans.
Harvard College Observatory, Cambridge, Mass.
Hammitt, John W., College Hill, Ohio.
Harris, T. C., Raleigh, N. C.
Heaton, Isaac E., Fremont, Nebr.
Hoskinson, R. M., Bainbridge Island, Wash T.
Heacock, J. L., Quakertown, Pa.
Hyde, G. A., Cleveland, Ohio.
Haywood, John, Westerville, Ohio.
Hartzler, J. A., Mottville, Mich.
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Hatch, A. H., Windsor, Ill.
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Hall, J. B. Worcester, Mass.
Hunter, Dr. T. C., Napoleon, Ohio.
Hall, Chas. C., Dudley, Mass.
Humphrey, Dr. L., Fairbury, Neb.
Hurlin, Rev. Wm., Antrim, N. H.
Helm, Thos. B., Logansport, Ind.
Hazen, Rev. A., Deerfield, Mass.
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Ireland, W. H., Rappahannock, Va.
James, John W., Marengo, Ill.
Jones, Dr. E. U., Taunton, Mass.
Jackson Company, Nashua, N. H.
Jordan, Dr. M. D. L., Milan, Tenn.
Kirkwood, E., Mauzy, Ind.
Kaucher, Mrs. Wm., Oregon, Mo.
Knapp, J. G., Limona, Fla.
Keese, G. Pomeroy, Cooperstown, N. Y.
Kuhne, F. W., Fort Wayne, Ind.
Ladshaw, G. E., Pacolet, S. C.
Lueps, Miss Anna, Manitowoc, Wis.

*Observer and place of observation.*

Lincoln, A. T., Marion, Va.
Loomis, J. C., Jeffersonville, Ind.
Luther, S. M., Garrettsville, Ohio.
Lamb, Miss Bertha E., Sterling, Kans.
Loud, Prof. F. H., Colorado Springs, Colo.
Lerch & Rice, Bethlehem, Pa.
Loundes, R. T., Clarksburg, W. Va.
Morgan, L. Ray, Philipsburg, Pa.
Marshall, Gregory, Cresco, Iowa.
McDonogh Institute, McDonogh, Md.
McCready, Miss L. A., Fort Madison, Iowa.
McClintock, Frank, West Union, Iowa.
McKenzie, Dr. M., Centreville, Mo.
Moore, C. R., Bird's Nest, Va.
Micklen, J. H., Variety Mills, Va.
Macrae, Colin, Kirkwood, S. C.
Meehan, Thos., Germantown, Pa.
Mominger, E. R., Flat Rock, N. C.
Moore, Nathan, Grampian Hills, Pa.
Mikesell, Thos., Wauseon, Ohio.
Mitchell, Dr. D. W., Harrisville, Mich.
McCarthy, Gerald, Kendall Green, D. C.
Moore, Dr. J. W., Easton, Pa.
Motte, L. S., West Milton, Ohio.
Newbiegin, John D., Anna, Ill.
Newcomb, G. S., Westborough, Mass.
Newell, W. C. T., Henry, Dak.
Norcom, Prof. T. J., Reidsville, N. C.
Neal, Dr. J. C., Archer Fla.
Nordberg, Prof. A., Richardton, Dak.
Olds, H. D., Cedar Rapids, Iowa.
Owsley, Dr. J. B., Jacksonborough, O.
Osborn, Dr. T. C., Cleburne, Tex.
Penrod, Dr. H. J., Upper Mont Clair, N. J.
Peele, Capt. A., New Westminster, B. C.
Pearce, Thomas, Eola, Oreg.
Pollock, Edward, Lancaster, Wis.
Partrick, J. M., North Volney, N. Y.
Purdue University, Lafayette, Ind.
Peckham, Prof. W. C., Brooklyn, N. Y.
Patterson, Dr. F., Comfort, Tex.
Pendleton, A., Nicolaus, Cal.
Postma, H. Y., Egg Harbor City, N. J.
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Romig, J. K., La Grande, Oreg.
Randall, E. H., Poultney, Vt.
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Rerrick, R. H., La Grange, Ind.
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Rogers, F. M., Luling, La.
Roberts, Luke, Clinton, Iowa.
Rodman, T. R., New Bedford, Mass.
Runge, C., New Ulm, Tex.
Richardson, C. F., Beverly, N. J.
Rotch, A. L., Blue Hill Observatory, Blue Hill, Mass.
Rathburn, J. C., Midland, Tex.
Rice, Chas. W., Yellow Springs, Ohio.
Roeder, W. F., Zionsville, Penn.
Snell, S. C., Amherst, Mass.
Stone, W. E., Amherst, Mass.
Stern, Jacob T., Logan, Iowa.
Star, Prof. Fred'k, Cedar Rapids, Iowa.
Smith, H. D., Monticello, Iowa.
Simmons, Prof. W. G., Wake Forest, N. C.
Sanders, T. B. Susanville, Cal.
Slenker, Mrs. E. D., Snowville, Va.
Strong, W. C., Kent's Hill, Me.
Shriver, E. T., Cumberland, Md.
Shaw, E., Ninnescah, Kans.
Seltz, Chas., De Soto, Nebr.

*Observer and place of observation.*

Scott, Thos. G., Forsyth, Ga.
Smith, Prof. T. B., Fayette, Mo.
Stucky, Dr. C. T., Helvetia, W. Va.
Stone, Dr. W. C., Lakewood, N. J.
Slade, Elisha, Somerset, Mass.
Shriver, Howard, Wytheville, Va.
Sonedecker, Rev. T. H., Tiffin, Ohio.
Smith, John R., North Truro, Mass.
Sim, J. R., Summit, Va.
Scribner, H. F. J., Strafford, Vt.
Strong, S. B., Setauket, N. Y.
Samostz, Oscar, Austin, Tex.
Sherman, W. B., Manchester, Iowa.
Standenmayer, Dr. L. R., Lincolnton, N. C.
Spilman, J. J., Pierre City, Mo.
Swezey, Prof. G. D., Crete, Nebr.
Tilford, C. M., Mount Blanco, Tex.
Todd, Prof. David P., Amherst, Mass.
Thornton, Prof. N., Geneseo, Ill.
Teele, Rev. A. K., Blue Hill, Mass.
Truman, Geo. S., Genoa, Nebr.
Turnbo, Silas C., Pro Tem, Mo.
Terborg, Rev. J. E., Pekin, Ill.
Thompson, R. J., Tiffin, Ohio.
Voegeli, Adolphus, Des Moines, Iowa.
Went, E. C., Frankfort, Ky.
Washburn Observatory, Madison, Wis.
Wild, Rev. E. P., Newport, Vt.
Williams, Rev. C. F., Ashwood, Tenn.
Wing, Miss M. E., Charlotte, Vt.
West, Silas, Cornish, Me.
Wylie, Wm., Mount Forest, Canada.
Walt, S. E., Traverse City, Mich.
Woodstock College, Woodstock, Md.
White, J. G., Lincoln, Nebr.
Wells, Rev. Chas. L., Gardiner, Me.
Williams College Observatory, Williamstown, Mass.
Wolfe, John H. Wellington, Kans.
Wülfke, E. F., Independence, Iowa.
West, Dr. Jos., O., Princeton, Mass.
Washington Aqueduct: Receiving Reservoir, D. C; Distributing " "; Great Falls Reservoir, Md; Rock Creek Bridge, D. C.
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Willis, O. R., A. M., Ph. D., White Plains, N. Y.
Watters, Dr. Jas., Westmoreland, Kans.
Wigg, Dr. Geo., East Portland, Oreg.
Wright, J. W. A., Greensborough, Ala.
Whitmore, J. E., Gallinas Spring, N. Mex.
Wright, J. W. A., Livingston, Ala.
Wadsworth, Dr. J. L. R., Collinsville, Ill.
Widman, Rev. C. M., Grand Coteau, La.
Williams, Dr. A. C., Elk Falls, Kans.
Wedge, J. C., Fond du Lac, Wis.
White, Rev. J. H., Merritt's Island, Fla.
Whitney, Chas. E., Humphrey, N. Y.
Wilson, W. T., Clayton, N. J.
Wood, Jos., Bar Harbor, Me.
Walton, J. P., Muscatine, Iowa.
Wearmouth, J., University of Virginia, Va.
Waterman, Wm., Hay Springs, Nebr.
Yetter, Wm. G., Catawissa, Pa.
Yates, T. P., Factoryville, N. Y.
Young, Geo. R., Penn Yan, N. Y.

*Military posts from which meteorological reports were received, through the Surgeon General of the Army, in time to be used in the preparation of the Monthly Weather Review for October, 1886.*

Alcatraz Island, Cal.
Angel Island, Cal.
Assinaboine, Fort, Mont.
A. Lincoln, Fort, Dak.
Bayard, Fort, New Mex.
Benicia Barracks, Cal.
Bidwell, Fort, Cal.
Brady, Fort, Mich.
Cœur d'Alene, Ft., Idaho.
Concho, Fort, Texas.
David's Island, N. Y. H.
Gaston, Fort, Cal.
Gibson, Fort, Ind. T.
Halleck, Fort, Nev.
Hays, Fort, Kans.
Huachuca, Fort, Ariz.
Klamath, Fort, Oreg.
Keogh, Fort, Mont.
Lowell, Fort, Ariz.
Laramie, Fort, Wyo.
Lewis, Fort, Colo.
Meade, Fort, Dak.
McIntosh, Fort, Tex.
Missoula, Fort, Mont.
Mason, Fort, Cal.
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McDowell, Fort, Ariz.
Monroe, Fort, Va.
Madison Barracks, N. Y.
McHenry, Fort, Md.
Mount Vernon B'ks, Ala.
Niagara, Fort, N. Y.
Niobrara, Fort, Nebr. [Cal.
Presidio of San Francisco,
Plattsburg Barracks, N. Y.
Pembina, Fort, Dak.
Randall, Fort, Dak.
Robinson, Fort, Nebr.
Reno, Fort, Ind. T.
Ringgold, Fort, Tex.
Riley, Fort, Kans.
Snelling, Fort, Minn.
Saint Augustine, Fort, Fla.
Sisseton, Fort, Dak.
Shaw, Fort, Mont.
Selden, Fort, Nebr.
Sully, Fort, Dak.
Sidney, Fort, Nebr.
Spokane, Fort, Wash. T.
Totten, Fort, Dak.
Townsend, Ft., Wash. T.
Union, Fort, N. Mex.
Washakie, Fort, Wyo.
Walla Walla, Ft., Wash. T.
Wingate, Fort, N. Mex.

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Alabama State Weather Service, under direction of P. H. Mell, Jr., Auburn, Alabama.
Illinois Weather Service, under direction of Col. Charles F. Mills, Springfield, Illinois.
Indiana State Weather Service, under direction of Prof. H. A. Huston, La Fayette, Indiana.
Iowa Weather Service, under direction of Dr. Gustavus Hinrichs, Iowa City, Iowa.
Minnesota State Weather Service, under direction of Prof. W. W. Payne, Northfield, Minnesota.
Mississippi State Weather Service, under direction of Prof. R. B. Fulton, Oxford, Mississippi.
Missouri State Weather Service, under direction of Prof. Francis E. Nipher, Saint Louis, Missouri.
Nebraska Weather Service, under direction of Prof. Goodwin D. Swezey, Crete, Nebraska.
New England Meteorological Society, Prof. Wm. H. Niles, of Boston, Mass., President; Mr. W. M. Davis, of Cambridge, Mass., Secretary.
Ohio State Weather Service, under direction of Prof. B. F. Thomas, of the Ohio State University, Columbus, Ohio.
Tennessee State Weather Service, under direction of H. C. Bate, Nashville, Tennessee.

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| Reading down to 26 inches | $30.00 | Packing and shipping by express, | $2.50 |
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| | | | |
|---|---|---|---|
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| Light brass tripod for barometer | 10.00 | do. | .85 |

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| Thermometer for dry or wet-bulb | $ 3.00 | Packing and shipping by express, | $ .60 |
| do. wet-bulb, support for | .50 | do. | .20 |
| do. do. cup for | .90 | do. | .25 |
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| do. maximum registering | 5.00 | do. | .80 |
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| do. terrestrial radiation | 7.00 | do. | .60 |
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L. B. 11547, P. D., 1886.

| | | | |
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| Anemometer, "Robinson's," (velocity) | $22.50 | Packing and shipping by express, | $1.10 |
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| Wind vane, sunset | $ 8.00 | Packing, | $— |
| do. large | 65.00 | do. | 5.00 |
| do. "Eccard's" attachment for use with anemograph | 10.00 | do. | — |
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| do. | 107 C, | do. | 1.35 |
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| do. | 107 F, | do. | 1.75 |
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| "Loomis' " Meteorology | 1.60 |

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| | |
|---|---|
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| Rain-gauge, galvanized iron, with overflow and measuring-stick | 2.50 |
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